LIVE ARTICLES
ON
SPECIAL
HAZARDS

No. 10

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ON
SPECIAL HAZARDS

No. 10

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FOREWORD

The tenth volume of the successful series of Live Articles on Special Hazards is presented herewith containing among other articles a study of the fish curing hazard, silk manufacture and its hazards, chocolate manufacturing risks, peanut oil industry, aeroplane manufacturing, etc., etc. A complete index of all the articles in the ten volumes will be found at the back of this edition. Insurance men writing general lines will also be interested in "Live Articles on Accident Prevention," "Live Articles on Suretyship," "Live Articles on Life Insurance" and "Live Articles on Marine Insurance," which appear each year in form similar to this book. To the experts of the business who have contributed to this valuable series, the publishers hereby express their hearty appreciation.

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FISH FACTORIES AND THEIR HAZARDS.

Extensive Variety of Processes—Many Products—"Housekeeping" Big Fire Prevention Factor.

By Will C. Beale, Eastport, Me.

Fish factories, considered with reference to hazard, offer for inspection a rather extensive variety of processes attendant on a long list of products. The hazard, however, is the general hazard of food canning, possibly more or less intensified by the consideration of the oil element common to most of the fish canned.

REINFORCED CONCRETE FISH FERTILIZER PLANT.

In fish packing there appears to be no particularly dangerous inherent hazard, either in the material itself or in any phases of operation. The hazards, such as they are, always considering oil and its significance well to the fore, seem to vary identically with the degree of "housekeeping." Disregarded housekeeping, however, that predisposes to fire, is as worthy of analytic scrutiny as the most potential inherent hazard, understood and guarded against.

On the Atlantic seaboard the most important fish factories seem to be located in New England. The most extensive in output (2,500,000 cases) are represented by the sardine factories down on the coast of Maine. Sardine factories, from the nature

of their product, seem to offer the most interesting subject-matter for consideration, comprising, as they do, all the hazards of average fish factories, with a few additional ones peculiar to themselves. A detailed description of product and processes might prove worthy of interest. Other fish-factory variations in hazard will be touched upon briefly later on.

SARDINES.

Paradoxical as it may sound, a sardine is not a sardine; further still, we might say there are no "sardines." The name "sardine" is a word with no technical application from a zoological standpoint. It is a word originally used in Southern Europe to designate the small fishes schooling on the coast of Sardinia. These were pilchards. The American "sardine" is a herring—

TAKING SARDINES FROM A WEIR.

that is. the Atlantic coast variety, which represents the great bulk of the output; the Pacific coast sardine is still another species. The Atlantic coast sardine is a herring taken in its tender years; in its maturer state it is the more individual smoked herring, even the gross "bloater"—the identical fish. Sardines school most plentifully along the northeast Maine coast. The catch is restricted by law to the period from April 15 to December 1, and although some years bring generous schools in shore during the spring and early summer months, the bulk of the pack is made from August to the close of the season.

On the Atlantic coast the sardines are taken in weirs—fish pounds—along the shore; on the Pacific coast they are seined—*taken in nets off shore.* The fish are bought and delivered gen-

erally in standards of "hogsheads." From the weirs they are boated immediately to the packing houses in regular craft for this purpose, carrying, on an average, about 35 hhds. If the run to the factory is of some hours, the fish are slightly salted in the boats. Inasmuch as the catch is taken at a certain time of tide, which of course recurs later each day, to pack the fish, promptly and to best advantage means very often late hours and much overtime.

From above it may be seen that the sardine-factory hazard includes consideration of extra hours as required, and also closing periods of portions of each year.

SCALING, CLEANING, SALTING.

From the boats the sardines are hoisted to elevated runways, or sluices, filled with running water, which convey them into the factory and shunt them out into various pickling vats or tanks, in which process the scales become washed off. The pickling tanks contain a brine solution of about 90 per cent., and the fish are left in this on an average of about three hours, the length of time varying slightly in accordance with size of the fish. At the end of that time they are dipped out and spread on a broad, belt-like conveyor, running on an angle of perhaps 45 degrees direct from the pickling tanks to the "flaking" machine on the second floor. "Flakes" are wire screens on which the fish are spread to allow thorough circulation of steam or heat in the cooking, and air in the drying. They are made of heavy galvanized wire in size 22 x 36 inches. The flakes, spread thinly with the fish, are taken from the flaking machine and placed in tall metal racks running on wheels, ready for the next process.

COOKING.

The cooking process varies somewhat in different plants, and in different grades of pack. The method chiefly employed is to cook by steaming. The racks of raw fish are wheeled into "steam boxes," airtight, closet-like compartments lined with cement, built to contain a certain number of racks. These closets are equipped with a system of perforated steam-pipes and are fitted with tight-closing doors. The steam is turned on and the fish cooked ten minutes at from 250 to 300 degrees.

The racks are then run direct from the steam boxes into the drying compartments. These are long, low-ceiled, shaft-like compartments, through which a constant draft of warm air is forced. This air is drawn direct from outdoors through a manifold screen of steam coils by revolving fans, and the cooked fish are subjected to this moving current of warm air for upward of one and one-half hours, according to size.

In a very few plants the fish, after being steamed, are wheeled on runways into brick dryers over direct heat from coal fires

beneath. These dryers are constructed of several layers of brick, with chimneys offering adequate ventilation and draft. They also include several layers of brick and cement at the bottom, which rests upon piles directly over the tide. Generally well constructed, with ash-pits opening down into tide-water, they represent no particular hazard. The heat maintained is merely drying, not cooking temperature.

A small percentage of factories fry their fish in hot oil. This process is conceded to produce the finest grade of sardines, but it is not extensively used. In these factories the fish are dried first by the moving-air process, then fried in wire baskets, being carried by slow-moving conveyors through long vats of oil heated by steam coils.

PACKING.

From the dryers the racks of fish are wheeled direct to the packing-room. Sardines are packed entirely by hand, the work being done always by women. The packing-tables are fitted to accommodate two packers, the flakes of fish rest across the packing-table and each woman packs off her half.

The bulk of sardine products are sardines in oil and sardines in mustard. The smaller fish are packed in oil, the larger sizes in mustard sauce. A high grade of cotton-seed oil is used chiefly for American sardines, although of late years a certain percentage of the pack has been made in pure olive oil, in following the standard of imported goods. In addition to cotton-seed oil, some goods have been packed in peanut oil, corn oil and other vegetable oils, but in small quantities only. The mustard sauce used is compounded of mustard seed ground in vinegar, with turmeric, salt and cayenne.

Each packing table is kept supplied with stacks of sardine cans in flat trays, each can having received its proper proportion of oil from an automatic filler, which fills a tray of twenty-five cans at a time. The fish, should they run larger than the required size, are clipped to length by the packers, using shears.

The packing-room floor, almost universally of hardwood, before the pack is spread throughout with clean sawdust to absorb oil and grease from the packing process, waste, droppings, etc.

This oily sawdust represents one of the special hazards of fish factories and will be touched upon later.

SEALING.

The sealing processes are of late years done entirely by machinery. The process is a bending and swedging process, and no hot solder is used, as formerly. The cans are placed on metal-belt conveyors, the covers laid on in transit to the sealing machines, and the sealing machines spin them out, sealed, at the rate of sixty cans a minute.

BATHING.

The baths, which represent the sterilizing process used in sardine factories, are rectangular vats built of sheet iron. The sterilizing medium is hot water, which is heated by perforated steam coils in the bottom of each bath. The sealed cans are placed in these baths, steam turned on and the goods cooked at the boiling temperature—212 degrees—for two hours or more, according to variety.

CLEANING—SHIPPING.

The packed cans are cleaned in dry sawdust. From the baths they are dipped with chain dip-nets into the cleaning machine, a slightly inclined revolving cylinder containing sawdust. These cleaning machines deposit the cans on belt conveyors, which

"FISH STAND"—DRYING, SALTING, SMOKING.

carry them to the testing-cribs in the shipping-room. Here they are tested for leaks, and packed into wooden cases for shipment. Each case contains 100 cans of the "¼ oil" goods or 48 cans of the mustard varieties.

HAZARDS IN GENERAL.

With a few exceptions, sardine factories are of frame construction, and once well afire burn rapidly; but the last few years have brought remarkable improvements in working methods, and the operations, as conducted now, are eminently less hazardous. Not many years ago the cooking was done entirely in rotary "cracker-reel" ovens over coal fires. Fires in these ovens were of frequent

occurrence, and they always represented a possible cause of trouble. Up to the last few years the entire process of can-making was accomplished on the premises, with all its hazards of kerosene, kerosene soldering furnaces, hot irons and hot solder. Also the cans were sealed entirely by the hot-solder process, and, throughout, the processes were slow, more or less crude, and meant increased hazard from congestion and accumulation.

Now, however, the inherent hazards of sardine factories are few and comparatively simple to locate. In majority of plants the sole fires now are in the boilers only. There is now no oven-cooking hazard; the can-making with all its attendant bad features is eliminated—cans being purchased all manufactured and the sealing is now done entirely by solderless machinery. Along with these, many of the old, slow hand methods in the different functions are now replaced by rapid, efficient, machine operations, which eliminate congestion and accumulation of waste. Also the refuse and waste, which formerly were rendered on the premises for their oil content, now go to the fertilizing plants intact. Slowly, but surely, sardine factories are following the course of thorough efficiency operative in other branches of food production.

With a concern manifesting active interest in its housekeeping the inherent hazard of fish-factories might be reduced to a minimum. Oil and its agency constitutes the chief hazard. The floors of the packing and sealing rooms are swept clean of the sawdust absorbent at the close of each day's pack, the sawdust being dumped into the tide. This should be a rigorous function.

Baths should be set in concrete beds, so constructed that no accumulation of sawdust, however small, would be possible in the crevices between baths and flooring. Sawdust from the cleaning machines should be taken care of daily. Greasy sacks, greasy waste, any inflammable material saturated with oil should be rigidly looked after. In sardine factories the feature of rubbish accumulations is of more importance than ordinarily.

FISH STANDS.

There are other fish factories the hazards of which are of interest. The term "fish-stand" applies to plants which do a fish-curing business other than canning. In the curing of "line-fish"—salting and drying of cod, haddock, cusk, pollock, etc.—these plants represent but little inherent hazard, but in many instances they include also smoking processes for curing herring and other fish.

Smokehouses for this business, of which there are a great many on the New England coast, are almost entirely frame buildings, sometimes covering considerable area. They are built on piling, as a rule, with an earth floor ten inches or more in depth. The side walls are bricked or stoned up to a height of two feet

or more, or the walls to that height protected with sheet iron. The inside of these smokehouses are kept whitewashed, which is claimed to withstand sparks. Driftwood is used almost entirely for smoking, the action of the salt water rendering it of ideal inflammability for this purpose. This driftwood burns very slowly, with a minimum of active flame, smouldering until consumed. These smokehouses require constant surveillance in order to obtain the best cures in the fish. This may tend to reduce the number of fires,—however, it is an interesting fact that these buildings rarely burn.

SMOKED-HERRING FACTORIES.

The smoked-herring business has developed vast increases in output of late years. Whereas, originally, the fish when cured

BONELESS HERRING PLANT.—SMOKEHOUSES AT LEFT.

were marketed whole, they are now manufactured almost entirely into "Boneless Herring,"—the fish being skinned, boned, trimmed, and shipped, ready to eat, in small boxes containing from one to ten pounds.

In boned-herring plants the inherent hazard is the hazard of oil and attendant conditions, which ordinary care in cleaning up obviates largely. There is, however, a certain special hazard in heaps of accumulated herring skins, bones and waste, which from excessive presence of oil, when compressed in a mass, creates a chance of spontaneous combustion. Such waste should be kept outside the plant.

CLAM FACTORIES.

There seems to be nothing of a specially hazardous nature in

the canning of clams and shellfish. The clams in the sheds are thoroughly washed by hose, cooked in hot-steam coffers, shelled, clipped, washed many times, and packed in brine. They are sterilized, after packing, in steam retorts. Cans are bought ready manufactured, and the entire absence of oil, grease in the material, and the consideration of constant washing and cleansing processes renders the hazard from nature of the business very small.

MISCELLANEOUS FISH-FACTORIES.

In the last few years, the larger fish—the cod and haddock chiefly—have also been utilized for canning. Several such plants exist on the New England coast. As a rule, this enterprise has been in the hands of the larger fish-food producers, and the plants are modern, well-constructed, well-equipped and well-maintained. Located, for the most part, near the large fishing and shipping centers they are designed to take care of a large volume of business in an adequately efficient manner. Many of these plants are fire-resisting construction and some of them sprinklered.

The boneless-fish industry utilizing cod, haddock, hake and kindred fish seems to offer very little inherent hazard. These fish are almost entirely lacking in oil-elements, and the large part played by salt and brine throughout the plants that do any curing on the premises, minimizes any special hazard. Many of the plants buy their material ready cured, and their own operations represent the skinning, boning and packing in various styles.

In the canning of cod and haddock, the fish are slightly salted, steam-cooked, packed in cans and processed in steam retorts. The hazard of this business seems no greater than the average canning hazard.

A small percentage of the fish-food output is in glass, similar to beef, bacon, etc. Much of this product is fish sterilized by salt or smoking, and sealed by vacuum process. A few glass packages represent fish-food sterilized after packing, in steam retorts, similar to tin containers, none of which adds to the ordinary canning hazard.

Of the fires in fish-factories of known origin in the writer's experience the past few years, three incipient fires were from neglected accumulations of sawdust; one—easily extinguished—from a greasy piece of sacking thrown across a steam-pipe; two from steam-pipes on wood, and one from defective boiler conditions. None of these constituted a loss.

In the last five years the losses have been very small, and to trace back to the losses of previous years would mean back-tracking to a period of entirely different physical conditions. While most of the past losses seem to have been after closing

hours, yet, in a period of twenty years, the writer does not recall a fish-factory fire in the closed-season period.

As to hazards to-day, moral and physical: the moral hazard in fish-food-producing plants the last few years seems to be extinct. Prices for fish foods have at last followed the upward trend of other food supplies, and profits have been fairly good. At best, moral hazard is a "fourth dimension" to treat,—a matter of divination, rather than computation, and within the ken of a super-insurer only.

As to physical hazard, we should say: "Look to the house-keeping."

HAZARD FROM OPEN GAS JETS.

By S. T. Skirrow.

The following incident may serve to show why there are so many fires of unknown origin, and points out the moral that open flame gas lights should not be left unattended while burning.

In the home of a wealthy resident of New York a few weeks ago the butler was dressing before a mirror. At the side of the mirror an open flame gas light was burning. The butler was called to another part of the house, and in his haste neglected to turn out the gas light. It happened that there was a sudden jarring of the building (possibly a heavy vehicle had just passed), and a probable variation in the pressure of the gas in the pipe* caused the lava tip of the gas jet to loosen and fly out on the carpeted floor, where it landed in its extremely hot state. Immediately the carpet burst into flames, sending smoke throughout the floor and causing a general alarm among the servants. The butler had presence of mind, however, and with a chemical extinguisher succeeded in extinguishing the blaze without serious damage to the other rooms. As soon as the fire was extinguished it was found on examination that the lava tip was out of the gas jet, and after a careful search the innocent gas tip was located on the floor in the center of the burned area.

* NOTE.—It is a recognized fact that the pressure of gas varies with the supply and demand; for instance, between the hours of 5 to 7 P.M. when almost every one is using gas the pressure is low, but after the rush hours the flow of gas is very great and can often be heard making a sizzling sound. Sudden closing of a device using a great quantity of gas will also cause a quick increase in the pressure.

SILK MANUFACTURE AND ITS HAZARDS.

Methods of Production—Worm Culture—Processes and Tests—Fire Record.

By E. P. Stover, Superintendent Special Risk Department, Security Insurance Co., New Haven, Conn.

The art of manufacturing silk seems to have originated with the Chinese at a very early period. According to the written records of these people the art seems to have been practised by them 2700 years before the Christian era. Until the reign of the Roman Emperor Justinian, the silk worm was cultivated only in China, though the raw silk had been purchased and manufactured for a long time before by the peoples of Persia and the countries surrounding the Aegean Sea. Silk was very little used in Europe, however, until the reign of Augustus. In the sixth century, two monks brought some eggs of the silk worm from China and India to Constantinople, and the Emperor Justinian encouraged them to breed the insect for its cocoons. Shortly afterwards silk manufacturing was established at Athens, Thebes and Corinth—comprising raising the worms and cocoons, unwinding them, twisting the threads and weaving cloth. This became a source of great wealth to Venice, while silk from the Greek empire found its way to western Europe for a long period of time.

For six centuries silk manufacturing remained in this state, until in 1146, King Roger I of Sicily conquered Greece and transported many of the people engaged in the industry to Palermo and Calabria, where they were compelled to found this industry. From these places the business spread through Italy, to Spain, from which country it was introduced into France. Mulberry plantations for silk worm culture was much encouraged by Henry IV, and since that time they have been a source of most beneficial employment to that nation.

In the United States the growth of the silk industry was slow. The cultivation and production of silk was commenced at a very early period. In 1623 all settlers in Virginia were ordered to plant mulberry trees for the silk worm and Charles II at his coronation wore a robe and hose made from Virginia silk. The cultivation of silk in the Carolinas was a fashionable occupation before the revolution, and the raw material was sent to England to be manufactured. In Connecticut silk culture was the subject of legislation in 1732 and Governor Law in 1747

had the honor of wearing the first coat and silk stockings made of New England silk, while his daughter in 1750 wore the first silk dress of domestic material. A large mulberry orchard was planted at Mansfield and another at New Haven about 1760. The Revolution terminated silk culture in the colonies, though it was partially revived after the peace in Connecticut, Massachusetts, New York, New Jersey and Pennsylvania. The first mill in America making sewing silks was erected in Mansfield, Conn., about 1820, and the first silk made by power machinery was also made there in 1829.

The following figures from the census report of 1914 will give an idea of the magnitude of the industry in the United States. At that time there were 902 manufacurers, employing 108,170 people, earning $47,109,000. The capital invested was $201,072,000 and the value of the products reached $254,011,000. Out of about 25,000,000 pounds of fibre consumed nearly 2,000,000 pounds were artificial silk.

Silk has certain well recognized properties, among which may be mentioned an unusual degree of softness. Its diameter ranges from .005 to .001 inch, while that of cotton ranges from .0005 to .0009, and linen from .0015 to .006 inch. Its weight is lowest of all textile fabrics after the gum is removed, consequently light weight fabrics can be made from it. Pure silk will wear for years, even though given hard wear. It is the strongest of all fabrics in relation to its size, when the gum has not been removed. Its elasticity and ductility are high when it has not been boiled off and a thread may be stretched from 1/7 to 1/4 of its original length. It exceeds all other textiles in luster.

THE SILK WORM AND ITS CULTURE.

Roughly speaking there are two general varieties of silk: the product of the cultivated and silk worms. There are several varieties of worms, about 60 per cent. of them produce once a year, some twice, and still others several times annually. With the latter classes the first crop after cold weather is considered their best; though the worm which produces once a year in temperate climates is considered to produce the best silk. In temperate climates the silk is usually strong and even, while in the tropics it is soft and bright.

The manner of cultivation and growth of the mulberry are important factors in successful rearing. The cultivated worm passes through four stages in its life of a couple of months, viz.: egg, larva, chrysalis or pupa, and adult—a cream white moth about one inch long. Mating follows. The female lays several hundred eggs during her three days of life. These are laid on sheets of paper or pieces of muslin which are gathered, hung for a few days in a damp atmosphere and then kept in cold storage for about six months. This period of cold is advan-

tageous for later hatching, which is done by heat. In the cocooneries each worm is kept absolutely clean and has plenty of room—as overcrowding brings disease. The leaves of the white mulberry are the best food. These are chopped fine during the early ages of the worm. When hatched, the worms are less than ¾ inch in length and about the diameter of a hair. During the first age they eat about thirty meals daily—equivalent to about their weight. It is said that the silk worm during its life eats about 30,000 times its initial weight, and increases in weight from 10,000 to 14,000 times.

When full sized, the worm is about 3 inches long and his hunger lessens and the lifting of the fore part of the body indicates a desire to climb and spin. Brush and twigs are provided and the worm climbs and encloses itself in its silken shell by expelling two delicate liquid threads from two openings under its mouth; these are joined into one on issuing. They come from the internal glands and the liquid hardens as it is exposed to the air. The method of spinning the cocoon is by a movement of the head, as if making a figure eight, weaving back and forth. The silk in one cocoon is a continuous double thread fastened together by the gum, the length varying from 300 to 1,400 yards. The worm wastes away as the silk is exhausted and gradually changes into a chrysalis. Cocoons intended for silk are subjected to heat to kill the animal, since if the moth is allowed to issue, it cuts and spoils much of the fibre.

Wild silk is growing in importance. It is called wild because the worms are hatched in the open and not in nurseries. The leading varieties are Tussah silk of China and India and the Japanese wild silk. The cocoons are larger and produce coarser and harsher silk than the cultivated.

The principal silk raising countries are China, Japan, Italy, France, Spain, Austria, Hungary, Russia, India and the Levant; the first four being the most important.

THE PRODUCTION OF RAW SILK.

The process of taking the silk from the cocoons is called "reeling." At the plants where this is done the cocoons are first sorted and classified as to color, size, shape, wrinkles and condition (mouldy, defective or perfect). The fibre varies in thickness in the cocoon, tapering down in size toward the interior. In reeling, several cocoon filaments are united, and they must be overlapped in such a way as to produce that evenness of size which is essential.

Several cocoons are floated in a basin of boiling water and brushed until filaments which will unwind are found. These are joined into one thread and wound into hanks on the reels which are connected with the basin. This work is done both

by hand and power machinery, and the product is raw silk. In this condition it is imported into the United

ARTIFICIAL SILK.

It may be somewhat surprising to some to read that artifi silk plays a very large part in the manufacture of mater commonly sold as silk. Artificial silk is hardly inferior beauty to natural silk and can be dyed with excellent resı On the other hand its firmness and durability are much than natural silk.

There are a number of methods of manufacturing this cc modity, usually from cellulose or cellulose derivatives. The different nitro-celluloses, partly mixed with resins, c fish glue, etc., in suitable solvents (collodion silk). (2) T esters of cellulose with organic acids especially acetic (acet silks). (3) Cellulose xanthogenate (viscose silk). (4) Sc tion of cellulose in ammoniacal copper oxide. (5) Solution cellulose in zinc chloride. (6) Solutions of cellulose in s phuric acid and phosphoric acid. (7) Solution of acid cellul in caustic potash. (8) Solutions which contain no cellulose cellulose derivatives as a base.

The oldest kind of artificial silk is collodion silk, discove by Chardonnel. This involved the hazards of the manufact of gun cotton and produced a highly inflammable product.

It is manifestly impossible to take up these various proces in detail within the scope of this article so the writer will c fine himself to a brief outline of the process in use by a v large corporation manufacturing artificial silk in the Uni States. Ordinary sulphite pulp is used and this is dissolved a strong solution of caustic potash. After aging for a f days this solution is treated with carbon bisulphide in revolv churns. The use of bisulphide introduces a hazard which sho receive careful attention. The mixture is treated with a solut of caustic potash in water which absorbs the superfluous sulphide, and eliminates this hazard. This mixture is stir until it is about the consistency of syrup. This is forced throı capillaries (very small orifices) into a trough containing dil sulphuric acid. This causes it to harden and retain its fc as a thread. The remaining processes consist merely in blea ing with chloride of lime solution and drying in an ordin steam heated dry box of the type usually used for drying yaı The yarn is then either reeled into hanks or wound on spo ready for shipment.

This product has about the same degree of combustibility cotton yarn, but will not ignite so readily as there is no f on it. The fire risk of this yarn is considered about on a with cotton yarn. When made into goods with real silk

artificial silk yarn follows the same processes as the real article except that it does not pass through the hands of the throwster.

TESTS FOR ARTIFICIAL SILK.

It frequently becomes necessary to determine the proportions of artificial silk in textiles. The following methods are employed:

The stuff to be tested is heated for 10 minutes to 200°. After this time the artificial silk is still intact so far as the structure is concerned, but is completely carbonized, so that it falls to pieces on being touched. Cotton, wool and natural silk remain unaltered and show hardly any trace of a brown or black color. If the heated cloth is rubbed after it has cooled sufficiently, the artificial silk will be removed as dust, and by comparing it with another piece of the original cloth, it can be exactly determined which and how many threads consist of artificial silk.

True silk will turn yellow if treated with nitric acid while artificial silk is not affected.

SILK MANUFACTURING PROCESSES.

Mills manufacturing broad silks or ribbons seldom perform the preliminary processes. The raw silk is sent first to the throwster where it is steamed and soaked to remove the gum, and then dried. After drying the silk is wound on reels and doubled (two or more strands wound together if desired) so that it comes from the reels in a skein. Organzine is used for the warp of the finished fabric—i.e., the threads which run lengthwise of the piece. This is usually made from the better quality silk and each thread is spun separately, then the threads are hard twisted (in the opposite direction from spinning). Tram is used for the weft, i.e., the threads running across the piece or fillers. This is slack twisted and if necessary doubled and twisted again.

These processes are those commonly carried on by the silk throwster who usually works materials owned by others. They do not present any special hazards of note except that of drying.

YARN DYEING.

At the dye works the silk is usually again reeled to prepare it for dyeing. It is then washed; a very high grade of soap being used. An inspection of a dye works would probably prove somewhat of a disappointment to the novice, an endless array of tanks, wet floors, plenty of steam in the atmosphere, and the iron soled shoes of the workmen being most prominent in the dyeing department proper. Great care must be exercised in preparing the dyes as silk must when finished match the desired shade exactly. If blacks are dyed they are usually weighted

with bichloride of tin or other metallic salt to make them heavier, increase the closeness of texture and improve the feel. Weighting up to 60 per cent. is considered light; up to 150 per cent. as medium, and to 300 per cent. heavy.

After dyeing the yarn is dried on frames to prevent its shrinking and again wound into skeins.

The hazards connected with these plants are chiefly due to the storage and use of chemicals, but usually well understood and guarded. Sulphur and sodium peroxide are used in bleaching. Picric acid is used as a dye. Nitric acid is sometimes used in making iron nitrate. There are also various dye stuffs, some of which may present a hazard. Where weighting is done it is important to ascertain how heavy the materials are loaded—as this constitutes a spontaneous combustion hazard in the goods, proportionally to the amount of loading.

In some dye works a complete soap factory will be found, though due to the high grade product, the hazards are mild for this class of risk, the raw stock consisting chiefly of glycerine and olive oil. Tin reclaiming (from weighting liquor) presents an ordinary furnace hazard and the use and storage of lime.

SILK WEAVING.

The silk as it comes from the dye works—and at this point artificial silk and sometimes mercerized cotton are introduced if they are used—is wound on quills or bobbins (quilling) which go into the shuttle of the loom. This is tram and forms the weft or filler of the material. Organzine, used for the warp is wound (beaming), on a large wooden cylinder called a beam. This is set up from ten to twenty feet from a large frame where each thread is set in its proper order and each must be continuous and wind on to the beam so that in weaving, the longitudinal threads of the material will be even. This process constitutes a most embarrassing trap for the uninitiated or careless inspector, as the threads extending from the frame to the beam are invisible under certain conditions, and to walk into them causes considerable labor for the operative.

Weaving is the operation of producing cloth from threads and is performed on a loom. The essential parts of this machine are an arrangement for stretching the warp, a contrivance (the heddles or harness) for raising each alternate thread of the warp and depressing the other half so as to open a space for the shuttle, which carries the weft, to pass through, and a contrivance for striking each weft thread close up to the one previously thrown. This constitutes plain weaving and is used for single color goods and checks. Figure weaving requires a Jacquard attachment, so named after its inventor, Marie Joseph Jacquard, who was born in Lyons and exhibited his invention first in 1801. By means of this invention any figure may be

woven into the goods—and even pictures produced which will compare favorably with an oil painting. This apparatus can be attached to most looms, it being a device to direct the movements of the individual warp threads necessary to produce the pattern. In plain weaving half the warp threads are raised and the other half lowered each time the weft passes through. If, however, a pattern is to be produced, it is necessary, instead of raising and depressing the whole threads of the warp, in two sets, to raise only such as are required to develop the various parts of the figure. This must be done with gread exactness as the position of every thread tells upon the formation of the pattern.

FINISHING.

When plain broad silks and ribbons are produced, finishing is done at the weaving mill, and usually consists merely of inspecting the goods, picking out knots or other inequalities with a small pair of tweezers and removing spots with gasoline. This latter is used in very small quantities and usually from safety cans.

When fancy printed fabrics are produced, they are usually sent to the print works, where the designs are printed from copper rolls directly onto the cloth or upon the warp before weaving. Piece goods are sized and calendered on large heated cylinders arranged like a wringer. Moireing is done on a special gas heated roll. Tentering consists of stretching the material by means of a special frame which carries the silk slowly along over steam coils. Singeing, which removes any fuzz from the fabric is usually done by passing the material over a red hot plate or by means of an open flame.

HAZARDS.

The hazards of weaving mills and print works are mostly self-evident. In the writer's opinion an attic—where odds and ends accumulate—is not the least by any means.

Because of the great value of the material handled, the inspector should give special attention to the quantities of silk carried, and where it is kept, the construction of the silk vault including method of draining and lighting it and whether the stock is skidded or not.

Harness dressing for oiling the harness of a loom consists of varnish, linseed oil and bees-wax; usually prepared in small quantities over a gas plate.

The number, arrangement and location of Jacquard looms should be noted, as the average overhead harness is liable to greatly facilitate the spread of a fire.

The method of heating calenders and moireing machines should be noted as well as the patent hazard of singeing.

FIRE RECORD.

Through the courtesy of the National Fire Protection Association the writer was favored with the following information relative to the fire record.

In 85 fires—36 were from common causes, 19 from special hazard causes, and 30 unknown, incendiary and exposure. Of the 36 common cause fires 6 were due to power, 6 to lighting, 5 to boiler (or fuel), 4 to smoking or matches, 2 to sweepings or rubbish, 2 to locomotive sparks, 1 to lightning, and 10 to miscellaneous causes among which several were from spontaneous combustion in coal and from thawing frozen pipes. Of the 19 special hazard fires, 7 were reported as occurring in dryers, 6 from static electricity, and 6 from other causes. Sixty of the fires occurred in sprinklered properties, and 25 in unsprinklered. Fifty-seven involved small loss, 16 large loss, 7 no claim, and in 5 cases no data was available, 10 of the large loss fires occurred in unsprinklered properties and 6 in sprinklered. The damage in some cases being largely from water.

HAZARDS OF CHOCOLATE-MAKING.

Turning the Cocoa Bean into a Finished Product—Processes Attended Usually by Certain Minor Fire Dangers

By James R. Hinton, Engineer, Continental Ins. Co.

The manufacture of cocoa and chocolate is a very interesting operation and appears to present very mild hazards. There are, however, several hazards which require special attention. There are also a number of secret operations applying principally to the proportions of the mixtures used by the several firms and are of little or no interest from an insurance standpoint. Among the principal hazards are the roasting ovens, hull grinding, and the dust from the hulls and cocoa grinders, all of which will be treated later. There are some firms manufacturing low grades of cocoa from the hull of the bean, which process is a very

Cocoa Factory Loss.

Only the walls remained after the fire some months ago at the Brewster Cocoa Manufacturing Company in Jersey City. The loss was over a half million dollars and the insurance was carried by the Factory Insurance Association.

hazardous one, while other firms are using substitutes in the manufacture of chocolates.

COCOA BEANS.

The cocoa bean is raised in South America and other tropical countries and grows in a "pod," each pod containing from five to ten beans resembling an almond in size and shape. These are gathered by the natives, the pods removed and the beans shipped in large bags. Around each bean is another shell or "skin," which will be referred to as the "hull" in this article and which presents one of the principal hazards in a plant of this class. The better grades of cocoa beans contain about 50 per cent. cocoa butter, a fat which is so valuable that a number of firms manufacturing cheap or low grades of chocolates are substituting cocoanut oil for the cocoa butter.

ROASTING.

When ready to be manufactured into cocoa or chocolate the beans are conveyed to the cleaning room, where they are cleaned to remove all foreign substances. This is sometimes done by hand, but in the larger plants it is done by machinery. Where the beans are cleaned by machinery, the machines should be well equipped with magnets so arranged that all metal, such as nails, tacks, pieces of wire, etc., will be drawn from the stock.

The beans are then placed in large ovens and roasted. Here is presented a hazard which deserves careful inspection. The floor under the ovens and on all sides for several feet (more especially in front) should be properly protected—it is preferable that these floors be of reinforced concrete. The ovens are usually heated with direct fire heat, soft coal being used as fuel and special care must be taken to see that the stacks are properly arranged. This hazard has been the cause of numerous fires, although a comparatively low temperature is maintained in the ovens, and deserves special attention. After roasting, the beans are emptied into medium-sized carts or trucks and allowed to cool. These trucks should be of metal; wooden trucks should not be permitted even though they are tin or metal lined. Trucks should be allowed to cool in the same room where the roasting is done and as the beans are hot and likely to contain sparks from the ovens, they should be kept free from combustible material. The floors under these trucks should properly be metal covered. If the beans are crushed before thoroughly cool, a fire is sure to result sooner or later.

CRUSHING AND GRINDING.

The beans are now cleaned and crushed in a large revolving machine and air forced through the contents, which blows the

hulls from the beans into sacks or storage bins. This process produces more or less dust. The hull contains a small percentage of cocoa butter and if allowed to accumulate in dust form is subject to spontaneous combustion or dust explosion.

Here the process differs to some extent between the better and the lower grades of finished products. In the lower or cheaper grades the hull is not removed from the bean, but they are ground together, which increases the hazard. After crushing, the beans are ground in small sized revolving machines and the pulp, in a semi-liquid state, is caught in pans and allowed to congeal, either in the room where manufactured or in a cold storage room, in which case the hazards of a cold storage plant are introduced.

SPRINKLERS TURNED OFF?

Another view of the Brewster Fire. It was a sprinklered risk, but the report is that a small fire occurred in the evening and after it was out, the water was turned off. During the night another fire broke out and the factory was totally destroyed.

PRESSING.

After the pulp has congealed it is conveyed to the press room and the cocoa butter is pressed out, with the exception of a small percentage varying according to the grade of cocoa to be manufactured. The presses are of the hydraulic type and similar to those found in cottonseed and linseed oil plants. The

butter is caught and placed in pans and allowed to cool and harden and is either sold or used in the manufacture of chocolate or milk chocolate.

COCOA.

The cake from the presses is conveyed to the cocoa grinding room and placed in a large round container, trough-shaped, having a large stone which travels through it, held in place and pulled by a central post with an arm arranged to hold the stone in place. This stone, traveling through the cake, grinds it into a powder. From here the cocoa is packed in cans ready for the market.

The dust in the grinding room will ignite spontaneously under favorable conditions, there being such a small percentage of cocoa butter present in this substance. This combustion usually takes place in the form of an explosion. This hazard is increased where the hull is ground with the bean as there will be found more dust present and an even smaller percentage of butter in the cocoa.

CHOCOLATE.

In some plants, after the pulp of the bean has congealed, it is placed in small-sized, cradle-shaped mixing machines, equipped with an arm so arranged that it travels through the mixture the entire length of the container. Here the sugar and additional cocoa butter and, in some cases, a small amount of flavoring extract is added, the mixture being heated at low temperature with steam heat. After mixing it is poured into moulds, placed in cold storage and allowed to harden, when it is packed and shipped.

In other plants, cocoa is mixed with the cocoa butter, sugar and other ingredients in the same manner as outlined above, producing the same results.

In still other plants, a cheap or low-grade chocolate is made by first manufacturing cocoa, thereby removing the larger percentage of cocoa butter and then replacing the cocoa butter with other oils. The cocoa butter, being very valuable, finds a ready market at a good price to the producer. The substitute generally used is cocoanut oil, principally on account of its cheapness as compared to the cocoa butter and because it is practically odorless and tasteless when properly refined. Where oil is used as a substitute for the cocoa butter there is an increase of hazard presented, due to the presence of the oil, which, unlike the cocoa butter, is a liquid, and the floors are likely to be found greasy and oily. It might be well to investigate the financial condition of firms making this class of goods.

COCOA HULLS.

Where the hull is merely sacked direct from the crusher

there is little dust given off and the hazard is very slight, but where the hulls are ground there will be found considerable dust. The room where the hull grinding is conducted should preferably be detached from the main plant and of fireproof construction. If the process is carried on in the main plant, the room should be fireproof and well cut off from the other portions of the risk. A number of plants dispose of the hulls, after blown from the crusher, as fertilizer. This material is said to be excellent for this purpose on account of its high nitrogen content. The farmers near one of the plants recently inspected by the writer haul this material away as fast as it accumulates.

Some firms grind the hull with the bean, using both in their product, thus making a lower grade cocoa and chocolate, which seems to have a good trade on account of its reduced price. This increases the hazard on account of the dust from the cocoa grinding machines, which will be found more noticeable. There is on the market, so I am advised, a so-called "cocoa" usually sold under a trade name on account of the laws governing food products, which is made from the hull of the bean only.

I understand that there is a firm which buys the cocoa hulls and grinds them into a powder, which is then treated with either naphtha or ether. The liquid is then drawn off and distilled, recovering the ether or naphtha and leaving the cocoa butter in the still.

MILK CHOCOLATE.

In some of the large milk chocolate manufactories will be found a dairy depot and condensed milk department with the usual hazards, while in the smaller ones condensed milk is purchased. Chocolate is manufactured as outlined above, with the exception that perhaps a larger percentage of cocoa butter and sugar is used than in ordinary cooking chocolate, and condensed milk is added. This is mixed for a number of hours and is heated by steam. After being thoroughly mixed, the chocolate is poured into moulds and placed in a cold storage room until thoroughly firm, when it is wrapped, packed and shipped. In all plants manufacturing this class of goods will be found a refrigerating system similar to those used in all cold storage plants with the familiar hazards.

After grinding, the powdered chocolate intended for this class of product is stored in large wooden bins until ready for use, generally cut off from the balance of the plant or, possibly in some of the smaller plants, in the room with the manufacturing processes. Chocolate in this condition presents little spontaneous combustion hazard on account of the large percentage of cocoa butter present.

It is possible that the inspector will find nuts being shelled,

cleaned and roasted, but this is a process usually found in most candy factories and will not be treated here.

NATURE OF FIRES.

Cocoa and chocolate burn readily and make a fire which is difficult to combat. These substances do not burst into flames rapidly, but smoulder, giving off a dense smoke, which often makes it hard to locate the fire, and firemen usually are unwilling to venture far into the room. A recent fire in a large plant in Pennsylvania gives an example of burning chocolate. The fire was discovered by the night watchman and promptly reported over the alarm box in the building where it originated. The private fire brigade together with the local fire department responded promptly. Upon their arrival smoke was seen coming from the piles of chocolate, but no blaze was in evidence and about an hour was spent trying to locate the fire in order to avoid excessive water damage. Finally the smoke banked to such an extent that it was necessary to use gas masks in order to fight the fire. The smoke continued to bank until such a quantity had accumulated that it exploded and the fire immediately spread over the contents of the room. The burning cocoa butter cooked out of the chocolate and floated on the water. It was several hours before the fire was extinguished and it resulted in a total loss to the stock on this floor and a considerable loss on the building.

A recent fire in a similar risk located in Vermont is now being investigated by the government. The cause of the fire is given as an explosion of cocoa dust from ground cocoa in or near the "cyclone," forming part of the suction system for handling this material. Here the force of the explosion bulged the walls and jammed the fire doors and the firemen were handicapped by the dense smoke from the burning cocoa. The insurance loss in this case is understood to have been about $700,000.

INCIDENTAL PROCESSES.

In most plants of this class will be found other processes carried on which are familiar to all inspectors. The processes consist of box making, both paper and wooden shipping boxes, tin can making, printing and mould making.

CONCLUSION.

The hazards in this class as a whole are mild, where the better grade of cocoa and chocolate is being made and where the special hazards are properly installed and arranged. The principal special hazard is presented in the arrangement of the roasting ovens and care of the dust from the hulls and the cocoa grinders. The latter becomes more severe in plants making

a low grade product and lines should be regulated accordingly. Cocoa beans and stock in process are liable to heavy smoke loss due to the intense smoke which accompanies chocolate fires.

To illustrate the increasing demand for this class of goods it might be well to state that in 1860 the consumption in the United States was 1,185,054 pounds, while in 1915 the consumption was about 175,116,064 pounds.

COTTON SEED FIBRE RISKS.

Chemical and Other Treatments Described—Hazards of Operations—Safeguards to be Observed.

By Oscar A. Smith, Memphis, Tenn.

The raw stock of cotton fibre mills comes in the form of cotton seed hulls, the making of which has been described in the article on cotton seed oil mills. This is either unloaded and delivered by conveyors (more often of the screw type) to the warehouse for later use or sent by means of screw conveyors to the grinding division of the plant. A section of the conveyor is made of metal with steam jacket. The dryness of the hulls is regulated by this heat before they enter the first attrition mill. In most mills a permanent magnet is interposed in the conveyor so that no metal may be permitted to enter the attrition mills. These grinders are of steel and run at high speed. The hulls after passing through the first mill go to a beater for the separation of the free hull meal from the fibre and remaining hulls. This process is repeated until passing the eighth attrition mill and beater. The resulting fibre is of very short length and singularly free from flash hazard.

ATTRITION MILL HAZARD.

It is not an uncommon thing for fire to originate in the attrition mills, but it is readily detected, the machinery stopped, the part opened up and the smoldering fibre raked out and rolled out in a wheelbarrow to the dump. A clump of this fibre may be lighted by a match, but it will not flash—smoldering very much like "punk."

The hull meal is conveyed to the hull meal house and the fibre sent to the baling room for baling and storage in the fibre warehouse.

In some plants are to be found a division where mixed feed is prepared. The cotton seed meal from the cotton seed oil mills is here ground with cotton hull meal in attrition mills in varying proportions, according to the different classes of feed; sacked and shipped. This feed is sold for cattle and other stock feed. No hay or other substances are used except prime cotton seed meal and cotton hull meal.

Returning, now, we find the baled fibre carried to the next division of the plant, where the process of purification begins.

CHEMICAL FEATURES.

We come to a division of the plant where the caustic soda in drums is stored. These are opened up as needed and the caustic soda mixed with water in vats or tanks to the required degree for use in the digester division. This solution is called "liquor" and the division the "liquor room." This is usually separated from the other divisions of the plant. If the plant is sprinklered it will be necessary in this division to see that the heads are protected against corrosion. Otherwise they will soon be put out of working order.

The fibre is purified by a chemical treatment—boiling at high temperature with alkaline substances, the process removing the oil and meal which had been left with the hulls in the oil milling processes.

This operation is carried out by means of a series of spherical digesters, usually 7 inches to 12 inches in diameter and holding a large quantity of fibre—say 2 to 2½ tons. The digester or boiler is filled with the fibre, which has come to the charging room in bales, and the requisite amount of alkaline liquor added. The manhole is closed, steam admitted through the hollow trunnions until the pressure reaches 20 to 30 lbs., at which pressure the boiling continues for three to six hours, according to the requirements, the digester rotating slowly the entire period in order that the fibre may be evenly and thoroughly boiled.

The liquor referred to is a solution of caustic soda, carbonate of soda or milk of lime. Caustic soda is preferable because it acts upon the grease and other fatty matters, forming a soluble compound, which is easily removed in the subsequent washings.

When the fibre is sufficiently boiled the steam is turned off and the pressure allowed to fall. The manhole is then opened and the contents permitted to fall into the catch basin below. The "block liquor" as it is called is then permitted to flow away. New water is flowed in and the mass is pumped to a tank, where a preliminary washing is given.

WASHING PROCESS.

The more complete washing process is carried on in the beating engine. This is a shallow, oval-shaped vessel with circular ends, divided lengthwise by a partition called a mid-feather. This, however, does not extend the full length of the machine. In one of the two channels is a heavy roll fitted, which is provided with a number of steel knives. On the floor of this channel is a fixed bed plate, also fitted with knives parallel with the knives in the roll. The action of the two sets is similar to that of the two blades of shears, and any substance passing beneath the roll is subjected to the shearing action of the knives.

In the other channel of this beater is fitted a drum washer,

which serves for the removal of the dirty water from the machine. This drum is divided into sections by means of partitions, which reach from center to circumference. The surface of the drum washer is made in such a way as to permit the water to pass through its surface, leaving the fibre to pass on.

Into this machine is dumped a batch of the partly washed fibre and clean water flowed in until the machine is suitably filled. The rotation of the heavy roll causes the mixture of fibre and water to circulate round the vessel, the floor of which is so constructed that the pulp is drawn between the rolls and "bed plate" and discharged over the "back fall," which is that portion of the stoping floor behind the "bed plate."

The "drum-washer" rotates with its surface in contact with the mixture in the engine, so that the dirty water passes through the wire cloth and is caught in the sections or buckets and discharged into a trough adjacent to the center, and conveyed away from the machine. Clean water is allowed to run into the vessel at one end while the dirty water is discharged by the "drum-washer." This process is repeated until the mass is clean and ready for the next process.

The fibre is then pumped to the "potcher," a vessel in some instances of rectangular shape, being provided with paddles to keep the mass in circulation. It is in this machine that the bleach liquor is mixed with the fibre pulp.

From the "potchers" the pulp is pumped to washing tanks, where all the residue bleach and other soluble compounds are washed out. These processes all require an immense amount of clean, clear water. And this keeps everything in that division of the plant in a very damp condition.

REMOVAL OF MOISTURE.

From the washers the fibre in a semi-fluid state is pumped into draining vats, where the water is permitted to drain out gradually. After a larger part of the water is drained away the creamy mass of fibre is forked out and handled by pneumatic pipes to centrifugal driers, where the larger part of the remaining moisture is removed. These centrifugal driers are of the type used in most modern laundries and present no serious hazards from the fire underwriter's standpoint.

The next machine in the operations is the automatic steam dryer of the continuous belt type. Here the fibre is put upon a slowly moving endless wire belt and passed through the machine, emerging as a thoroughly dry substance.

These dryers are of a type similar to those in use in various textile plants and are manufactured by such people as the Philadelphia Textile Machinery Co. of Philadelphia or C. G. Sargent's Sons of Graniteville, Mass.

The drying chamber of these machines is heated by steam coils

located on one side of the machine. The air is circulated by the use of disc fans alternately through the coils and then through the stock on the conveyor. This air, when saturated, is removed by an auxiliary fan.

FIRE PRECAUTIONS.

In machines built by such reputable firms as just mentioned one need not be apprehensive of fire dangers. Every precau-as possible to make without the installation of automatic sprinklers. It is, of course, desirable to have this added protection where possible. If no such protection can be afforded, it would be well to have an arrangement for steam jets, for no dryer is devoid of occasional fires.

The thoroughly dried fibre is now in small lumps about the average size of a pea. This is easily carried by a blower or pneumatic system to the press room, where it is baled into packages about 1.5 x 2 x 3 feet, wrapped in heavy paper for shipment to the paper mill or to the munitions plants, where it becomes a large constituent of explosives of various types.

If not loaded directly into cars, the bales are piled in an orderly manner in the warehouses awaiting shipment. This warehousing is of no special hazard. Being wrapped so securely there is no opportunity for lint or fibre to collect on the floor, and these warehouses will be found to be exceptionally free from litter.

MIXING COTTON.

In most plants there are times when it is necessary to use a certain amount of linters and at times even a certain amount of short staple cotton in order to produce just the character of refined fibre required to meet certain conditions. In which case a cotton picker machine is necessary to open up the linters or cotton in such a way as to make the fibre easily handled.

This picker machine is usually put in a separate building, both for convenience and for safety from fire standpoint. It is identical with the picker used in mattress factories in preparing the lint for the felting machines and in cotton pickeries where burned cotton and country damaged or "water pack" cotton is conditioned and put in bales for sale. It consists of a rapidly revolving drum which in some instances is provided with a series of saws as in a gin. These should be protected by a magnet to remove metal from the lint. This cotton or linters, after being opened, is picked up by a pneumatic system and carried to the charging room which is located above the digesters.

FIRE DIVISIONS.

In an ideal plant there should be about the following fire divisions:

(1) Hull warehouse.

(2) Grinding and milling.
(3) Warehouse for fibre and linters.
(4) Boiler house.
(5) Engine and dynamo plant.
(6) Digester and bleaching department.
(7) Picking division.
(8) Drying and baling.
(9) Warehousing of finished product.
(10) Liquor division.

It is needless to say that the greater dangers lie in the mill division and the dryer division. The divisions may be effected either by clear space or by fire walls. If by the latter, all openings in division walls should be protected by double standard fire doors. In one of the largest of such plants in this country the mill division is in duplicate, one being operated in connection with the refining processes and one in a distant part of the city. In this way a shut down as the result of a small blaze is obviated. This arrangement has come about from experience with fires where the plant was unsprinklered. While sprinklers are supposed to handle all fires where no break down of the system arises from explosion or other causes, we are inclined to recommend to the prospective builder of fibre refineries the operation of the milling division in duplicate.

INCREASED CAPACITY.

This duplicate system in addition to obviating a possible shut down from small fire loss in the milling division gives greater capacity for certain processes and enables the plant to work up a larger quantity of hulls during the cotton oil season and storing the fibre for use during the slack season. In this way the plant changes from a seasonal plant to one of continuous operation except for the possible shut down of three to four weeks in August for overhauling and repairs. This becomes necessary if the plant is operated twenty-four hours per day as so many are at the present time.

It will be noticed by the careful underwriter that there is very little special machinery used in a fibre refinery. The attrition mills are of a common steel type, the beaters are those used in the cotton oil mills for the separation of the meal from the hulls. The digesters, beaters and potchers are of the type employed in paper and pulp mills. The centrifugal driers may be found at laundry supply houses. The driers are those in use in textile plants and tobacco plants. The pneumatic systems are of the type used in cotton gins and cotton oil mills. All this has a very direct bearing on the use and occupancy line written on such plants.

CARELESSNESS, CHURCH HAZARD.

Applies Also to School Houses—Poor Design and Construction Contributing Factors—Frequent Inspections Needed.

By Howard Campbell, Insurance Engineer, Kansas City, Mo.

The principal fire hazard of a building used for strictly academic or religious purposes appears to be carelessness, for the inherent hazard of such risks should apparently be quite low, but their fire record is bad. Carelessness may be shown in several ways. First in poor design and construction of the building. The ordinary wooden framed building, whether it has brick or wooden walls, is, at the best, little more than a fire trap. And when the heating plant is installed under the very center, and the only exits are through the halls, which pass through that center, the trap is complete, and needs only a careless janitor or thoughtless boys to have a "holocaust." The tendency to use fireproof construction, in at least the part containing the heating plants, is an encouraging sign of an awakening consciousness on the part of our school boards.

RUBBISH HAZARD.

Another evidence of carelessness is the accumulation of loose paper and other rubbish in the boiler room, in closets, under stairs and in other places. The hazard of this lies not so much in the danger of fire starting there as in the fuel provided for the rapid spread of fire which has started elsewhere. There is some danger of spontaneous ignition in waste paper piles, but that could occur only through the introduction of oily rags, oily sawdust from floor sweeping compounds or other readily oxidizable matter. Oily rags might be those used in wiping off polished furniture, or left by painters, etc., or from the repair bench, in larger schools. There is also, at least in newspaper accounts, a chance of fire from "mice and matches," but that would seem to be remote in these classes of risks. Where kitchen work is done, as discussed below, this hazard is increased, and needs consideration. Matches should be kept in metal receptacles, or preferably be of an approved safety type. Care should be taken to keep the waste from the kitchen separate from the litter from the rest of the building, as it attracts mice and is liable to spontaneous ignition, especially if piled up with paper in a nice warm furnace room, next to a wooden partition.

The hazard of combustible litter, which is inherent in both churches and schools, is best controlled by having metal trash cans, made of heavy material, with self-closing cover and a brick bin for the storage of the litter until it can be burned. A baling machine would soon pay for itself, through the cash received for this baled paper, and that would teach the pupils two lessons: conservation of utilizable material and fire prevention.

INSPECTIONS NEEDED.

The personality of the janitor should not be overlooked and frequent inspection of his work would in many cases improve the fire hazards and probably save heavy loss. These inspections should include the furnace room, broom and mop closets, spaces under stairs, attics and any other spaces not readily seen. The writer has found some startling conditions in janitors' closets. In one case, a gasoline stove was found burning under a stairway, with the door to the room closed and no one there. It was used to heat scrub water. Bottles of gasoline are a frequent feature of such rooms.

With the introduction of the institutional church and manual training and domestic science, the hazards of churches and schools have become more complex. The processes carried on involve all the hazards of the same processes on a commercial scale, but the small amount of material used and the short time occupied considerably reduce these hazards. They are none the less real and should be carefully guarded.

COOKING

is one of the greatest of these hazards. The range, or stove, should be set on a fireproof floor, or on a properly protected wooden floor. As baking is done in these stoves, they are hot for quite a long time, and should be as well guarded as any in small restaurants or dwellings. That requires a layer of brick or, better, of hollow tile, with sheet iron, where the stove comes within four inches of the floor, or if, as is often the case, especially with gas stoves, there are legs more than four inches high, sheet metal and ¼-inch asbestos is sufficient. The cement floor in the basement is the safest place. The stovepipe should be kept well away from wood and should not pass through a partition or floor. If a smoke hood is used the vent pipe should not come within 18 inches of any wood and should be cleaned out frequently. They are usually very greasy and burn fiercely.

Gas or gasoline hot plates should be used only on tables with slate or cement tops, or wooden tops protected with asbestos and sheet iron. It is strange how many hot plates are found without proper protection, or connected to gas fixtures with *rubber tubing.* Only rigid iron pipes should be used, as they

will not pull off, will not leak and do not decay, as rubber tubing or most flexible metal pipes will do. The pupils' attention should be called to these precautions as a part of their education. Electric stoves are becoming cheaper and are used in many schools. They are very safe if properly installed and used, but dangerous if not cared for. A telltale or pilot light should be connected across the wires to all such stoves, so that they will not be left turned on and become overheated. Each stove should be protected by individual fuses, and the wires should be amply large, and otherwise in accordance with the National electrical code.

DRESSMAKING AND MILLINERY

are hazardous on account of the litter, the occasional use of gasoline for cleaning and the use of flatirons. The same precautions apply as for hot plates and electric stoves in kitchens. A safety can will minimize the gasoline hazard.

WOODWORKING

is hazardous in schools, principally on account of the combustible litter. A blower system should be connected to each machine, with fireproof shavings vault and other well-known precautions. Usually this is impractical and the litter must be cleaned up by hand. In either case a fireproof bin should be provided for the shavings, well away from the fire box of the furnace. Often a special trash burner is used, which should be well safeguarded. Attendant hazards are the use of oily rags and excess oil on the machinery. Also the use of varnish or paint. The latter should be stored in a metal locker and limited to the smallest practical amount. Approved cans should be provided for the rags and waste and emptied every day. Motors and other power devices should be properly enclosed and safeguarded.

MACHINE SHOP WORK

is hazardous, principally on account of the power used, and the oil, waste and rags used. Care should be taken to see that an excessive amount of oil is not used and if the floor gets oily, it should be protected with sheet iron, turned up at the edges slightly. Where oil is used on the cutting point, metal pans should be provided for the shavings and should be emptied promptly, at the close of the day. Iron shavings or filings, if oily and slightly damp, are subject to spontaneous ignition. They should never be handled or stored in wooden receptacles or bins or piled on wooden floors. They have little market value and should be thrown out on the ground.

FORGING

should be done in a separate room on an incombustible floor.

The sparks are not hazardous unless they reach combustible material, like shavings or gasoline vapor, but the chunks of hot metal cut off or the articles being forged are often thrown or laid on the floor, and will set a wooden floor on fire. Sheet metal should be provided where wooden floors are unavoidable, extending well out on all sides of the forge and also around the anvil. Each forge should be provided with a smoke hood to carry off the smoke and also lessen the escape of sparks. If the forge is set near a wooden or plastered partition, sheet metal should extend well above the forge and on each side.

PRINTING

is also hazardous on account of the power used, the chance of excess oil, the use of gasoline for cleaning forms and the attendant litter. Wooden floors should be protected under all presses, except the smallest job presses, with sheet iron extending out at least 18 inches in front and somewhat less at the sides. Gasoline should be limited strictly to not over one gallon in approved safety cans. The glass bottles often found are dangerous, as they will break easily and will not stand fire. Ordinary cans are not tight, and will not withstand even small quick fires. Where stereotyping is done the furnaces should be in a separate room with cement floor and ample clearance to all woodwork. A paper baler should be an invariable feature of all print shops.

LABORATORIES

are of several kinds. Physical and zoölogical laboratories are almost non-hazardous, except for the occasional use of Bunsen burners, alcohol lamps and other small heat devices and the careless and unskilled use of electrical wiring and apparatus.

CHEMICAL LABORATORIES

may be almost non-hazardous, or extremely so. The kinds of chemicals used should be investigated and also the care taken to lock up those which are hazardous or which could form hazardous mixtures. The principal danger in school laboratories lies in the unauthorized experimenting of the students or an unwise professor. Common hazardous chemicals include alcohol, potassium and sodium nitrates and chlorates, charcoal, sulphur, phosphorus, metallic sodium, potassium, etc., strong acids and often special materials brought in for demonstration or use, such as explosives, calcium carbide, etc.

The Bunsen and other gas burners used present the same fire hazard as any portable heat device with open flame, and this is aggravated by the unavoidable use of rubber tube gas connections. These tubes should be of the best quality obtainable, should be securely wired to the burner and gas pipe connection,

they should be renewed as soon as seen to be even slightly deficient, and there should be no shut-off cock at the burner, so that gas cannot be left in the tubing under pressure when not in use. Slate or other incombustible tables should be used.

VENTILATING HOODS

present another distinct hazard. Chemical mixtures giving off objectionable fumes are placed in these "hoods" or cabinets, which are connected to chimneys or directly to the outdoors. Sometimes a gas jet is left burning under the mixture, with no immediate attendant. When made of fireproof material, which needs to be fume proof as well, these hoods present only a mild hazard. When made of wood, especially when a wooden ventilating pipe is used, they become very dry and the fire hazard is severe. Rubber tubes used in these hoods should be renewed very frequently, and should be avoided if possible, as the heat destroys them rapidly. Usually a jointed pipe can be used just as well, but the joints should be tight and have a shut-off cock only at the rigid pipe. Hard asbestos board or "transite" is probably the best lining for the hoods. Soft asbestos soon tears loose and is not advisable.

HEATING

of schools is probably the greatest unavoidable fire hazard. The concentration of the heating apparatus in a contralized location and the customary use of hot air aggravate this hazard, but if correctly installed it should not be serious. The usual arrangement consists of a furnace cased in brick, with "stacks" leading directly to the rooms, or delivering the hot air to a fan room, from which it is blown to the rooms. In a few fortunate cases the hot air is furnished by a nest of steam pipes adjacent to the fan room. If this steam comes from a boiler in a detached building, or in a fireproof room, the greatest hazard is removed. In either case the furnace or steam coils should be in a room with cement or brick floor, with at least two feet to any wood overhead, or, better, with a concrete ceiling and well ventilated. While the heat from the steam coils is too low to set wood on fire directly, the constant passage of hot air dries out the wood and would quickly fan even a small blaze into a bad fire. Several inches of sand on top of a hot air furnace is a good means of securing both safety and economy, as it sends the heat up the hot air pipes instead of letting it radiate out into the basement. At least 18 inches clearance to wood in the ceiling and walls should be maintained from the smoke pipe and from the hot air pipes within eight feet of the furnace, unless the wood is protected with a metal shield, held at least two inches from the wood and lined with ¼-inch asbestos, in which case twelve inches clearance would be sufficient.

The hot-air pipes or "stacks" leading to the rooms should, where they run vertically in the walls, be built of brick, but if that is not possible, double-walled metal stacks may be used. If plastered over, metal stacks should be protected with metal lath at all points within eight inches of the pipe.

The engine or motor used to drive the hot air and ventilating fans should be installed with unusual care, as fire starting in the fan room would soon be blown to all parts of the building. The usual precautions are too well known to be repeated here, and it would seem to be unnecessary to emphasize the installation of these power devices in a separate room, with only a small shaft opening into the fan room. A fire extinguisher should always be kept just outside the fan and motor room doors. A wire glass panel in the doors would permit a ready view of the interior and reveal a fire which might otherwise reach dangerous proportions before being discovered.

STEAM AND HOT WATER PLANTS

are usually safer than hot air plants, the only precautions needed being to see that the boiler and stacks are not too close to wood, that metal bushings are provided around all steam pipes at partitions and floors and that at least two inches clearance to wood is provided elsewhere. Also that the space back of radiators and in pipe runways or closets, through which pipes may pass, are kept free of foreign material, which might be ignited.

Ventilating systems are an often unsuspected fire hazard. Their hazard lies in their help in spreading fires to all parts of the building. Each room should have an individual ventilating stack, if any are used, built of brick or metal, and extending clear through the roof, or to a common central ventilator for several rooms, in the attic. A common arrangement is to have the brick stacks built up to the top of the attic floor and connected by metal stacks to the common ventilating hood.

In the Smead system the floors and partitions are used as part of the ventilating system, with floor registers leading to the ducts formed by the joists and studding. This has been shown by bitter experience to be highly objectionable and most fire marshals or inspectors have ordered them torn out and replaced by safer systems. When that is done, it should be made certain that all floor ducts are permanently closed, as the very obvious danger of fire spreading to concealed spaces is not otherwise eliminated.

DRY CLOSETS

introduce another peculiar fire hazard of school houses. These are used where no sewer systems are available and when properly installed are a very sanitary method of disposing of the deposits *from the* toilets. The vaults under the stools are made of brick

or concrete and connected to a ventilating stack, in which a stove is kept burning constantly to draw off the air from the vault and dry out the deposits. At convenient intervals, usually three or four times a year, kerosene is poured over the dried deposits and ignited. This leaves only a small amount of ashes, which are beneficial and not usually removed. If a reasonable amount of kerosene is used and the floors over the vault and the stools are incombustible, the fire hazard is quite low, but careless or ignorant work can easily cause heavy loss. Iron floors are almost always found, but wooden stools or at least wooden seats are often found. The stools should always be made of iron, with the wooden seats and covers lined with heavy iron on the under side. That will resist the heat during the short time it lasts. Occasionally gasoline is used by a thoughtless janitor and the result is apparent. As a rule these are well cared for and quite safe, but should be carefully investigated.

DORMITORIES

are found in large private schools and introduce the lodging-house hazards of carelessness, smoking and horse-play, modified, for better or worse, by the discipline of the school and the character of the students. The kitchen presents the usual kitchen hazards as shown above. The laundry is usually small and non-hazardous, but if there is a dry room it should be metal and asbestos lined and heated by steam, with the pipes on the sides only. Gasoline cleaning should be prohibited.

ENTERTAINMENT HALLS

vary from a simple platform, with no equipment, to an elaborate stage with considerable scenery, dressing rooms, lighting effects and other hazards usually found in theaters. With rare exceptions these present little additional hazard, especially considering the small amount of time they are in use.

THE FIRE PROTECTION

of churches and schools is usually more a make-believe than of real value, as small and insufficient equipment is provided. If sufficient fire extinguishers are provided to have one within easy reach from each room and near all stairways, and sufficient hose, not less than 1½ inches in diameter, with not less than 2-inch standpipes, with ample water supply, is provided on each floor, including the attic and basement, and the teachers and janitor are taught their use, they should have some value. Lack of care has made many otherwise good equipments worthless when fire came. The extinguishers should be recharged at least once in each school year, and the hose should be well aired out at least once in three months, water being run through rubber-lined hose to preserve the rubber, but unlined linen hose should be

wet only in case of fire, as it soon rots after being wet, no matter how well dried, unless aired very frequently.

LIGHTING

of these risks is often hazardous. In small towns glass bowl kerosene lights are used. Only metal bowl lamps should be used. Gasoline and acetylene lights are also found. These need the usual precautions and should be avoided where at all possible. With gas lights the principal fire hazard is the use of swinging gas brackets. These should have guard rings to keep them away from wooden door casings, etc., and should be made stationary if at all possible. Electric lights present the usual fire hazards of electric wiring. The use of conduit wiring and strict adherence to the requirements of the National electrical code will make this entirely safe, except for misuse, which is not subject to correction by rules.

With consideration of the fire hazard in the original design, careful attention to the fire hazards by the janitor and persons in authority and with the auxiliary hazards guarded as recommended above, churches and schools should be very safe risks and the lives of our children would be better cared for there than in the average American home, as far as fire is concerned. Where the precautions recommended in this report are not followed, or where the fire hazard is lost sight of, these become dangerous risks, both to the pupils, the city owning them and to the insurance companies.

SPONTANEOUS COMBUSTION.

By Charles C. Dominge, Insurance Engineer, New York City.

When no other cause can be found for the origin of a fire it is usually attributed to spontaneous combustion. This is much easier than to ascertain the real cause. Undoubtedly many fires are started in this manner in cabinets containing oily waste, and closets containing oily mops have been discovered on fire with these materials not entirely destroyed. Spontaneous combustion is brought about by a chemical action. For instance, oxidation takes place in the oily waste and heat is generated, which, not being allowed to escape, results in a rise of temperature to the ignition point. The conditions necessary for spontaneous combustion are (1) the production of heat; (2) an environment that is a non-conductor of heat, and (3) material with a low ignition point. To avoid spontaneous combustion do not heap material in a close place, and keep rooms thoroughly ventilated.

PEANUT OIL INDUSTRY.

Hazards and Processes—An Important and Growing Business in the South.

By F. E. MacKnight, Engineer, Continental, American Eagle and Fidelity-Phenix—Published by Courtesy of Those Companies.

At this time when conservation of foodstuffs is so essential, special attention is being given to the peanut, one of America's best and cheapest foods. Not only is it a substitute for wheat, but, being rich in protein and fat, it also serves as a meat substitute. The peanut is one of the most nutritious foods known and possesses a wide range of food possibilities. The demand for this legume for food purposes is increasing by leaps and bounds.

It is claimed that a pound of whole peanuts, as used in confections, peanut butter, etc., contains nearly one-half pound of fat and one-fourth pound of protein, both the oil or fat and the protein being of high grade and readily digestible. One pound of peanuts furnishes about 2,700 calories, while one pound of beefsteak yields less than one-third as much, and one pound of eggs less than one-fifth that amount. If the peanuts are pressed, and flour and oil utilized separately, a good wheat substitute is obtained in one case and a sweet, wholesome table and cooking oil in the other. Both the peanut itself and the meal or flour lend themselves well to all sorts of culinary purposes. It should be understood that the peanut is a food, not a condiment, and therefore can be used to replace flour, meat or fat. The oil extracted from the peanut is already one of the most important of the world's food oils.

The use of the peanut and peanut products as food has been highly recommended for the following reasons:

The oil is valuable as a table oil, equal to other oils in digestibility and food values; the shelled nuts are a splendid food, cheap and nutritious—the salted nuts are equally nutritious; peanut butter is highly useful in many ways, besides being rich in fat and protein. It is a butter substitute and likewise a substitute for meat; the whole shelled nuts as well as parts of nuts are well adapted for use in candies, cakes, cookies, wafers, etc.; the flour from the peanut itself or from the oil cake is a good part-substitute for wheat flour for bread making or for making baking powder, biscuits, cakes, gems, waffles, griddle

cakes, etc.; the use of such flour in bread making will save an equivalent quantity of wheat for our allies. The high protein content makes the peanut also a meat substitute.

"GOOBERS AND PENDARS."

Peanuts were first cultivated in Virginia, where they are also known as goobers, pendars and ground peas. As a commercial commodity, they were cleaned and polished for the retail trade, also shelled and sold as an edible product.

During the past few years the Mexican boll weevil invaded Alabama from the West, having traversed portions of Texas, Louisiana and Mississippi and, continuing on into Georgia, is now well established in both these States. Seed shortage at once developed and the oil mills were compelled either to curtail their output or shut down. As the cotton crop had been the ready money crop, it was incumbent on the farmer, as well as the cotton oil crusher, to find, if possible, a substitute for cotton. The peanut, it seems, comes the nearest to fulfilling the demand, as it affords a money crop and is adapted to the climate and soil. The peanut is a leguminous plant and could be beneficial to the ground were it not for the value lost in harvesting, both the nut (attached to the roots) and vine being plowed up. The nitrogen nodules form on the top root while the nuts grow near the surface. Without some method of harvesting whereby the legumes can be left in the ground a succession of peanut crops will impoverish the soil, making restoration by artificial means necessary. It would seem, therefore, that rotation of crops, if the peanut is to become a staple crop, is even more essential than with cotton.

In the early days of the industry the hulls were looked upon as a waste product, but a market has been developed for them, as they are said to be similar to cottonseed hulls as feed and are also mixed with peanut meal filler or reduced. No doubt hereafter they will be usefully disposed of.

Peanut oil is similar to cottonseed oil. In the crude state it is lighter in color, slightly more mobile and settles quicker. Its flash and burning points are about the same as for cottonseed oil, viz., 560 and 650 degrees Fahr. It is claimed that it is more readily refined than cottonseed oil with a loss of only 3 per cent. as against 7 per cent. It is used for the same purposes as cottonseed oil, such as in cooking compounds, salad oils, etc. In the producing section it is used without refining.

Peanut meal is used for fertilizer and feed and in its purer form it is claimed can be mixed with flour or meal in bread making. It is considered an excellent feed for animals, especially when combined with other feeds, such as hay, corn, oats, etc. As a fertilizer material the meal is said to yield 6 to 8½

per cent. ammonia, depending as to the quantity of filler incorporated from the hulls.

The development of the peanut industry, which has been hastened by the inroads of the boll weevil, may prove to be a blessing in disguise. At any rate, it serves to add another important crop.

PROCESSES.

After being harvested the peanuts are put through a picker, in the field, which removes to a considerable extent the dirt, at the same time separating the nuts from the vine. In this condition they are shipped to the mill, being neither washed nor dried.

With few exceptions the mills in the peanut growing section are converted oil mills. A few new mills built for the purpose have been erected. As the equipment in a cottonseed oil mill is entirely suitable for the extraction of peanut oil the conversion from one to the other can be made at little expense. This would not be true, however, in changing from a peanut mill (erected as such) to a cotton oil mill. The process in both are similar as far as concerns cleaning, crushing and expressing of the oil and also the grinding of the meal cake into meal. The peanut mill requires no linters or linter press, a point in favor of the peanut mill as far as comparison of hazards are concerned.

There are two general types of peanut oil mills; one using the hydraulic process wherein the meats are cooked and the other employing the cold process of extraction. In either type to clean the nuts they are first passed through a sand reel, then a shaker and some form of cleaner. So far the Foos and Davidson types of cleaning machines have been principally used, either of which removes the foreign matter, such as dirt and stones. Plants in which the nuts are shelled before being crushed are very few, where cotton oil machinery is used.

In the milling process proper hardly any two plants are alike or operate in exactly the same manner. Converted oil mills usually employ linters with the saws removed, which gives uniform feed. As in cotton oil mills, magnets on these machines take care of metallic substances. Except in the converted mills magnets are not used.

In the cold extraction process the nuts in the hulls are ground in a disc grinding machine and fed direct to Anderson expellers. A preliminary warming of the meats is secured by passing through a steam jacketed conveyor. The expellers are said to operate at a very high pressure (about 9,000 pounds per square inch) and an oil content of only 6½ per cent. is claimed as against 9 per cent. in the hydraulic process; also less help is required.

In the hydraulic process the nuts are usually passed through a huller first, either bar or disc type, falling on a shaker screen. At this point they are collected and go to a second mill, thence to the cookers. Oil is extracted by the usual operation of forming and expressing. Hulls are conveyed by screw or by pneumatic conveyors either to hull house—and ground and stored there—or to a disc grinder in the mill and made into meal which can be mixed with peanut meal and in this way a varied ammonia content secured. It may also be used in a feed mixture. By use of special hullers and cleaners, hulls as well as stems may be entirely removed, but the use of cotton oil machinery precludes the possibility of eliminating more than about 60 to 75 per cent. of the hulls.

The cleaning operations at present constitute the principal hazard. As in cleaning cottonseed, dust and dirt are prevalent, but in a lesser degree. The hazards of linting, also linter baling, as relating to the cotton oil industry are, of course, absent, which is in favor of the peanut mill. Some of the less important machines, such as separators, are not used, or if used employed in a simpler form. The danger from disc hullers is probably less, owing to the absence of lint; the discs can be set further apart, and usually are. The objectionable feature of untidiness is unquestionably more pronounced in the cotton oil plant than in the peanut mill, but the impression must not be gained that peanut oil mills are entirely devoid of dust and dirt, for such is not the case. If the same degree of improvement takes place in the peanut mill as was the case in the development of the cotton oil mill, there is no reason why the former should not be the better underwriting proposition. The industry as yet is comparatively new and hardly on a firm commercial basis. Improvement, no doubt, will result both as to arrangement of the processes and separation and safeguarding of the hazards, the same as in cotton oil plants, but the success of the industry, of course, will largely depend upon the manner in which methods are standardized and prices .stabilized. If necessary and properly equipped a mill could crush both peanuts and cottonseed in a single season, but not simultaneously. The large mills could afford to carry heavier stocks, thereby enabling them to operate for longer periods on account of their financial backing, while the tendency of the smaller plants would be to close down before the crushing season was completed, disposing of their stock to the larger mills.

VALUES.

During the crushing season the main values are to be found in the storage warehouses, the same as in cotton oil plants. Peanuts cannot be piled to the same extent as cotton seed; from 25 to 33 per cent. more cottonseed, by weight, can be stored

in a given space, than peanuts. The market value of peanuts, however, is practically double that of cotton seed and the increased value, therefore, in a warehouse filled with peanuts would probably average 33⅓ per cent. more than if filled with cottonseed. The market price of the oil is about the same. The price for cottonseed oil has been fixed by the United States Government. Due to the smaller loss in refining, peanut oil is slightly higher, but when the refining loss exceeds five per cent. the price is the same as cotton oil. The price of cottonseed meal has also been fixed; while that of peanut meal will vary slightly, in general, it is about the same as cottonseed meal, depending on the ammonia content. Peanut hulls brought $18 to $20 per ton in Texas last winter, but could be shipped there from Georgia and Alabama at a profit after paying a heavy freight charge. Peanut hay sold at about $20 per ton and an acre will produce a yield of about half a ton.

The quantity of oil obtainable from a ton of cottonseed varies; 32 gallons in Texas, 40 gallons in Alabama, 42 gallons in Georgia and 45 gallons in the Carolinas are said to be fair yields. A good average yield of peanut oil is from 72 to 80 gallons per ton; this varies in different sections, being largely influenced by conditions, soil fertility, season and maturing of the fruit. The Spanish peanut of the white variety is said to be the best producer. The crop of 1917 for Georgia has been estimated at 600,000 acres and for Alabama 1,000,000 acres. An average yield for these States is said to be about 35 to 40 bushels per acre. Farther West the industry is more fully developed, being older and therefore further advanced, and without doubt the aggregate production is greater.

SALVAGE.

It is claimed that peanuts or peanut hulls when once on fire burn quite freely and when in large quantities produce a prolonged fire difficult to extinguish, and experience has shown that peanut fires leave little or no salvage. However, they do not present the same opportunity for flash fires as cottonseed, and from an underwriting viewpoint this, of course, should be treated as an important point and given consideration.

CONCLUSIONS.

From the foregoing the following suggestions for precautionary measures suggest themselves:

Storage warehouses for peanuts should be in small units, say not to exceed 1,000 tons and as much less as the business will allow. Where the warehouse has a greater capacity the bin system, as in cottonseed warehouses, should be introduced.

The cleaning machinery should be preferably in a detached building or in a room cut off. No machinery not absolutely

necessary for the handling and conveying of the peanuts sh
be allowed in the warehouse, and the necessary precaut
observed to keep all machinery free from collection of 1
hulls or nuts. Hulls in quantities should be stored in a
tached building. Grinding hulls into meal should be condu
in a detached building or room cut off. When used for
under boilers the necessary safeguards should be provide
in planing mills.

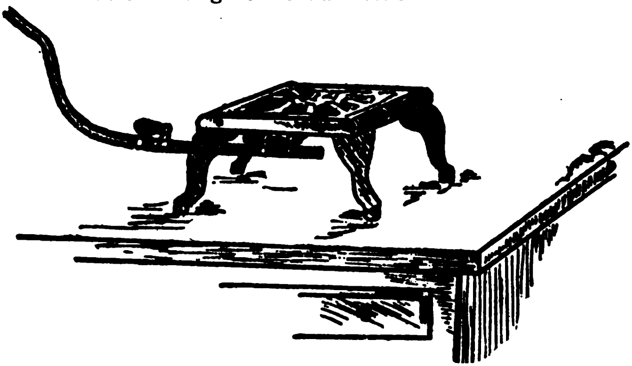
FURNISHED ROOMS AND BOARDING HOUSES.

An Unprofitable Class with Many Sources of Fires.

Written expressly for THE WEEKLY UNDERWRITER.

"Home, Sweet Home,—There Is No Place Like Home." The strong appeal in these few words would suggest that the author of them lived in or near a theatrical boarding house, housing a number of piano, ukelele and trombone players, all bent on breaking the atmosphere into small pieces at the same time.

Most of the furnished room houses are of the dwelling type, located in deteriorating residential sections.



Many unsafe stoves are to be found in kitchenettes of furnished rooms and boarding houses.

Owing to the exceptionally large number of fires in this class of risk, underwriters, as a rule, class this business as undesirable or at least not to be solicited.

Very recently the city authorities promulgated new regulations restricting the number of tenants doing cooking therein and classifying the building as tenements when cooking was done by any of the tenants.

As in all risks, especially dwellings, there is a wide difference in the class of roomers according to the district in which the building is located. Thus we have theatrical districts, professional men and women, laboring classes and family apartments where only one or two rooms are let out.

Strictly speaking, a furnished room house is one where all the rooms are let out singly or in suites comprising two or more rooms, with a few rooms set aside for use of the owner. A boarding house will be similarly apportioned and in addition have a kitchen where all meals are cooked and served in a common dining room.

FEW INCENTIVES TO CARE.

There is little incentive for care and cleanliness on the part of the individual roomers, except personal cleanliness, because all such houses have a charwoman who does all the cleaning. Paper, burnt matches, trash of all kinds find their way into closets, under beds, back of sofas and in other out of the way places. The furnishings of the room as a rule receive much abuse because the roomer does not own them. There is, therefore, no particular reason why chafing dishes, gas stoves, hot dishes or lamps should not be placed directly on the varnished table or chiffonier.

The careless smoker should be arrested.

Cigarettes cause many fires. Smoking in bed helps to swell the fire record.

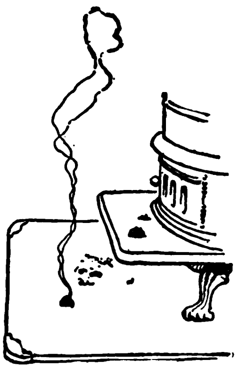
The majority of owners of these properties buy the furniture and furnishings second hand, because the wear and tear is so great that the newness of first hand goods would soon wear off. This applies of course to the ordinary rooming house. Furthermore, the roomers of the average house change their abode quite frequently, and there is a constant shifting of tenants.

SOURCES OF FIRE.

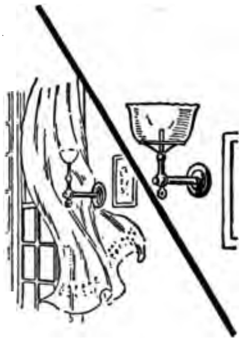
One of the great sources of fire is the use of cooking apparatus such as a one-burner gas plate, electric stove, kerosene oil stove, the top of a coal fuel cylinder stove or alcohol heated chafing dish. Nearly every connection to the gas apparatus is a rubber tube. As the roomer dislikes to cook in his or her combination "boudoir—sun parlor—sitting room," the stove may

be kept and used in a tiny closet, under a shelf, on the washstand or in some other dangerously confined place. Little, if any, attention is given to safe installation. Electric stoves or pressing irons usually have exceptionally long cords and if a number of these are on one circuit, the wiring is very apt to become overloaded. Unless the building is steam or hot-air heated, there will be found ordinary coal stoves of different types, gas logs, gas radiators, gas appliances attached in a manner similar to a gas light burner or a kerosene oil stove. These devices are installed in each room in a temporary manner and present an immediate fire danger unless safely arranged.

Smoking, too, has caused numerous fires, not only in bedrooms, but in the common lounge room. A recent fire in the sitting room of a furnished room house started after midnight and burned out two floors. The only cause given was that a



The floor covering must extend beneath the ashpit.



Gas flames must be protected by globes. This is one of the main hazards in this class.

carelessly thrown cigarette had lodged unnoticed behind a sofa. There is positive proof that fires have been caused by people *smoking in bed* and falling asleep before their "weed" had been extinguished. In furnished room houses, this occurs frequently. It may be that "my lady nicotine" is potent enough to lull them to sleep and make them forget they are in a furnished room house.

No greater evil can be found in furnished room houses than the *gas bracket* which swings against draperies, or which is so placed that draperies such as lace curtains can be blown against the flame. All such brackets should be stationary and have

wire cages around the flame. The ordinary glass globe is better than none.

The constant changing of transient guests is apt to introduce unwelcome guests that delight to infest beds and render still more uncomfortable the hapless roomer. The landlady must then resort to benzine or some other strong solution (usually an inflammable liquid) to rid the premises of these vermin.

AN UNPROFITABLE CLASS.

Boarding houses if properly kept and managed are better than the general run of rooming houses. The tenants are usually of a more substantial character and seek the boarding house where meals can be served rather than a room without board. This is especially true of those from out-of-town who come to the city with the intention of remaining for some time and cannot afford hotel life. If the boarder is at all satisfied, he is apt to remain, which reduces somewhat the hazard of a constantly changing transient trade. Aside from an occasional "chafing dish supper" very little cooking is done in the individual rooms and the rooms are kept cleaner and more "homey."

The furnished apartment is considerably better than the boarding house. The tenants are as a rule those who can afford better living quarters and maintain a condition approximating the usual domestic apartment.

The actor or actress owing to the nature of the profession entailing late hours is usually placed in the K. O. class of furnished room houses.

In conclusion, we may add that hardly a day passes without a fire in the *furnished room* type of risk, the present loss record being abreast of some of the other "notoriously" unprofitable classes.

MANUFACTURE OF PHENOL.

Increased Production Necessitated by War—Study of Processes and Hazards from Fire Protection Standpoint.

By James R. Hinton, Engineer, Continental Insurance Co.

Previous to the present war, phenol was obtained principally by direct distillation of coal tar; the demand for phenol since the war, however, has been increased to such an extent that the amount of phenol obtained by distillation is inadequate. For this reason there have been erected a number of plants throughout the United States for the manufacture of phenol from benzol (benzene), a coal tar product.

BENZOL

is a highly inflammable liquid boiling at 178 deg. F. and giving off volatile fumes at ordinary temperatures and is in a marked degree similar to gasoline and benzine, the petroleum product; the fumes, or gases, when mixed with the proper proportion of air, being subject to explosion. This will give an idea as to the nature of the material used in the manufacture of phenol.

SULPHONATING.

Benzol and sulphuric acid are measured in separate measuring tanks holding the proper proportions of the raw materials to be used. The benzol is now allowed to flow, usually by gravity, to a large metal tank equipped with steam jacket and a mechanical agitator. In a number of plants these tanks have an open top, but in most plants the sulphonating kettle is equipped with a vapor-proof cover and standard safety valves, this latter type of kettle being preferred provided the proper arrangements for disposing of the gases liberated in the process have been installed in such a manner that the contents of the kettle will not be subjected to pressure. After the benzol has been emptied into the sulphonating kettle the sulphuric acid is allowed to flow into the benzol slowly and the mixture continually agitated; this process is allowed to continue until all chemical reaction has been completed. There are several hazards in connection with this process; while being mixed it is necessary that the contents of the kettle be kept at a temperature of about 150 degrees. This is accomplished in one of two ways: (1) by allowing the sulphuric acid to flow rapidly into the benzol, or (2) by artificial heat. In the first method the chemical reaction causes

the mixture to heat rapidly and if extreme care is not exercised sufficient heat will be generated to cause the benzol to ignite; again, there is liability of damaging the product. For these reasons artificial heat is generally used. In the use of artificial heat the principal hazard is introduced where open fire heat is used, including gas flames. Benzol being very volatile, extreme care should be exercised in the arrangement and maintenance of the open flame furnace; the building and furnace should be so arranged and constructed that the fumes from the benzol cannot enter the furnace and so that sparks from the furnace cannot be blown into the sulphonating room; the furnace should be fed from the outside in all cases and should be properly vented; in cases where gas or oil flames are used, the same precautions must be taken, entrance to combustion chamber to be from the outside of building. It is preferable that steam heat be used for this process, boilers to be located in a well-detached boiler room. Where steam is used for heating, the boilers being located as explained, there is slight danger from fire in this process if proper care is exercised and the acid is not allowed to flow too rapidly into the mixture. The completed product in this process is benzol-sulphonic acid.

LIME BATH.

When all reaction in the sulphonating process has been completed the benzol-sulphonic acid is pumped or allowed to flow by gravity to large wooden tanks containing a solution of milk of lime, this mixture being continually agitated, forming benzol-sulphonic acid of lime (water soluble). In this process there is little or no hazard unless the chemical reaction in the sulphonating process has not been completed, in which case benzol fumes may be liberated, which would introduce the same hazards as outlined above. The mass is now conveyed to a filter press, usually by means of displacement pumps, where the liquid benzol-sulphonate of lime is filtered out, the sulphate of lime remaining in the press being disposed of. This process introduces no hazards of importance.

SODA BATH.

The benzol-sulphonate of lime is now conveyed to another large tank similar to the one described in the lime bath and containing a solution of soda ash, these chemicals being mixed with continual agitation, forming soda salt of benzol-sulphonic acid and carbonate of lime. In this process heat is seldom used and where heat is applied the same precautions should be taken as outlined in the sulphonating process if conducted in the same room, otherwise no extra precautions other than usual for boilers, furnaces, steam pipes, etc., need be taken.

One of the peculiarities of these compounds is in the fact

that it is necessary to first introduce the milk of lime and then the soda ash, otherwise the desired product will not be obtained.

The contents of the tank where the soda ash has been introduced is now drawn off to cooling tanks and allowed to stand for several hours. When the substance has thoroughly cooled the carbonate of lime, a solid, will settle at the bottom and the liquid soda-salt of benzol-sulphonic acid is drawn off and conveyed to evaporating tanks.

EVAPORATING.

The evaporating tanks or pans are usually large tanks equipped with steam coils. The soda-salt of benzol-sulphonic acid is allowed to flow into the tank and is evaporated to dryness. There is no hazard in this process unless open-fire heat is used and the process is conducted in the same room with the sulphonating process, in which case the same precautions should be taken as referred to under that heading.

FUSING.

The dry soda salt of benzol-sulphonic acid is now conveyed to fusing kettles. These kettles are usually heated to about 500 deg. to 700 deg. and special attention must be given to the heating apparatus, more especially if the process is carried on in the same room with the first or sulphonating process. In this process there is danger of the soda salt containing some benzol, which has not been completely changed in the processes outlined above, the fumes of which might be driven off by the high temperature used in this process; otherwise there is little hazard in connection with this process other than the usual heating hazards. The fusing kettle contains caustic soda and when the fusing has been completed, forms sodium carbonate and sodium phenolate. In a few plants the molten soda salt of benzol-sulphonic acid is allowed to flow into the caustic soda and then fused. This process is practically the same as the first described method and has the same hazards.

After fusing the mass is carried to acidifying tanks and dissolved in water, after which it is treated, while in solution, with sulphuric acid until the phenol is liberated. This process leaves two liquids, sodium sulphate and phenol in solution, which are pumped to storage tanks and allowed to stand for several hours, after which the two liquids separate into two layers; the top layer, phenol in solution, is drawn off and conveyed to a still, where it is distilled to recover pure phenol. Here again appears the heating hazard, which is no worse than the ordinary boiler hazards unless the process is in the same room with the sulphonating process, in which case the same precautions should be taken as outlined above. It is claimed that phenol will not break down under these processes and for that reason there is little or no hazard from benzol fumes being liberated.

CONCLUSION.

From the above it will be seen that the principal hazards in a plant manufacturing phenol are due to open fire heat and to carelessness in allowing the acid to be fed into the benzol in the sulphonating process too rapidly. These two hazards have been the cause of fires in this class of plants. Special attention should be given to the arrangement of the heating apparatus when making inspections of this class of risk, keeping in mind the hazards of benzol, the vapors of which are heavier than air. Special attention should also be given to the method of storing benzol, which should never be stored in the same room where the processes are carried on and should preferably be stored in detached tanks.

USES.

Phenol (carbolic acid) enters generally in the manufacture of picric acid (used in the manufacture of high explosives), dyes, dyestuffs and pharmaceutical chemicals.

STORAGE OF COAL.

Preventing Fire in Piles of Fuel—Conservation Element Vital To-day—Careful Study Necessary.

By W. D. Langtry, United States Fuel Conservation Committee for Illinois.

The present coal situation is such that the public in general are being advised to buy coal to insure as much as possible against a repetition of the shortage of last winter. It is advisable for all those who have the space available to buy early and stack their coal. This really ought to be made a compulsory order. Those who know the real coal condition are appealing earnestly to the public in general to protect themselves. It is a patriotic movement as well as one of real self protection. Those who can but will not heed this advice may be the ones who

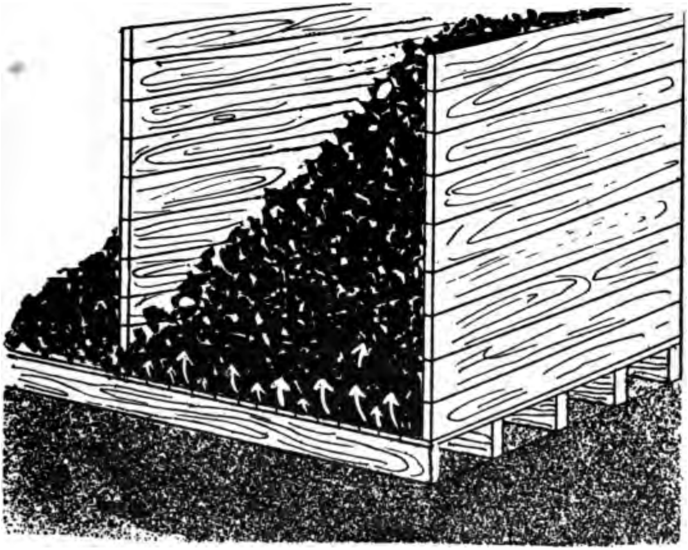


FIG. 1.

will suffer most both in a monetary way from shut downs and personal inconvenience next winter. The hundreds of difficulties that may come up between the actual mining of the coal in the ground and its delivery to the ultimate consumer, between now and fall are so many that even if price was a big factor, it really should not be considered. The public should buy—buy—buy coal at once.

To those who will buy and buy early, the storage of coal should have very careful attention.

Broadly speaking, the larger sizes of coal from about No. 3 nut and on up through the various sizes of nut, egg and lump, store without giving any trouble. This is due principally to the fact that these sizes are drier and offer a smaller surface, in proportion to their mass, to the action of oxygen, than the finer sizes do.

Anthracite stores well in any size, but oxidation occurs here also, but is much slower in action, and therefore, smaller in amount for any given length of time.

Sub-bituminous coal from the west, frequently called black lignite, is hardly suitable for storage. Its tendency to slack condemns it.

DELETERIOUS INGREDIENTS.

The finer sizes of coal, which are used principally for power purposes, are generally high in moisture and iron pyrites. These are deleterious ingredients because of the ease of oxidation of the pyrite in the presence of water vapor. The finer sizes, that is, coal passing through two inch screen and smaller, expose a great number of small surfaces to the air. These several factors all tend to initiate oxidation and to speed it along once it has started.

This fact necessitates a careful consideration of the methods of storage. These are three in number; under water storage, storage in closed bins, and in open piles. Under water any kind and size of coal may be kept for any length of time without danger of any sort from fire. This method is used by large consumers, like the Western Electric Company of Chicago, and the United States Navy Department. This provides a supply of coal which may be safely held for an indefinite period of time. All such concerns also hold coal in open piles for immediate use.

Storage in closed bins is generally limited to small quantities of fuel. These may be the winter supplies in homes or stocks in small retail coal yards. (Figure 1.)

STORING IN OPEN PILES.

The great bulk of storage coal at present is kept in open *piles. This is intended* to be held readily available for use

and is seldom on the ground for more than a few months. As a matter of fact it should not be kept for any great length of time, but, the length of time should depend on the kind of coal, since this is the most dangerous form of storage. However, when proper precautions are taken at the time the coal is placed on the ground and maintained while the pile lasts, losses may be eliminated, or at any rate, reduced to a minimum. These precautions will be taken up later since from now on only the finer sizes will be considered. The losses which occur may be considered to be due to oxidation.

In considering the mechanism of oxidation the general fact

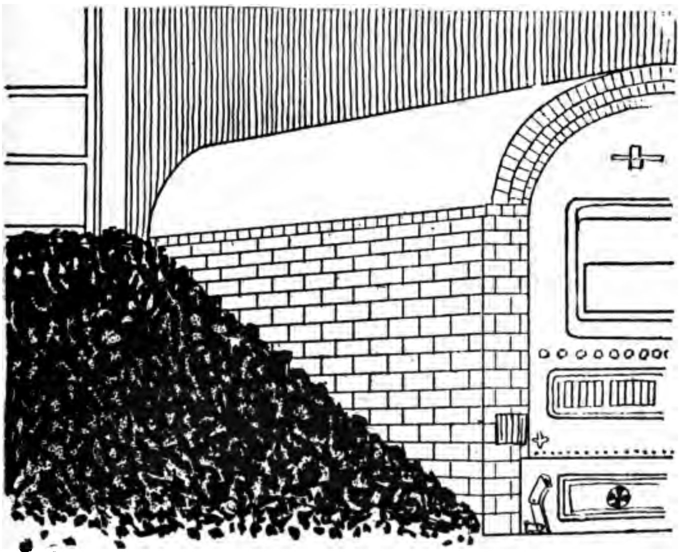


FIG. 2.

should be borne in mind that the rate of oxidation increases with increase of temperature. Also we must remember that coal is a poor conductor of heat, so that any heat occurring or generated in the interior of the coal pile stays there. These two facts indicate that when oxidation starts, even though at a low temperature, it generates a small amount of heat; this heat is insulated from the outside air, and, being retained, tends to increase the rate of oxidation. Thus one action helps the other and the oxidation proceeds at a constantly accelerated speed.

the more easily oxidizable compounds or constituents being attacked first.

Iron pyrite is oxidized in the presence of water to ferrous sulphate and sulphuric acid according to the equation:

Iron pyrite+oxygen+water=Iron sulphate+sulphuric acid+heat. This reaction takes place with a considerable evolution of heat. It is true that the oxidation really goes further with the evolution of still more heat, but, to consider this matter from a more conservative view-point, this additional heat, and also the heat due to the action of sulphuric acid on lime or alkalies present in the coal, or the heat generated by the dilution of the acid with water are not considered.

It must be remembered that the water actually enters into chemical combination with the pyrite and oxygen, unless the water is present in sufficient amount to exclude the air. This is the condition that prevails in under-water storage, and is one of the reasons why that method is best.

When coal is stored in the dry state the equation for the oxidation of the pyrite given above is incomplete, since the moisture component is absent. When it is stored under water the equation is again incomplete, because the air is thus excluded and the oxygen component is absent.

In other words, the oxidation in the dry state proceeds very slowly, since the only moisture available is that in the coal and in the air. In dry coal, the moisture is very low, so in dry storage one of the necessary constituents of the reaction is lacking to a relatively large extent.

SPONTANEOUS HEATING.

When coal is unloaded from wagons into basements it is generally sprinkled with a garden hose to lay the dust. This supplies the moisture, which is necessary for the oxidation. Several fires have occurred in Chicago, apparently from this cause.

The question has often been asked as to the best season of the year to store coal. The spring and summer are usually preferable so far as helping the railroad situation and keeping the mines running during an otherwise slack period. However, so far as considering climatic conditions, the disadvantage of summer storage is the temperature at which the coal may be put into the pile. The coal maintains this temperature for a considerable period, as it is a poor conductor of heat.

The heat due to the oxidation of pyrite, helped by that coming from external sources, if any, raises the temperature of the pile to the point where the carbon and hydrogen of the coal begin to be attacked. This action is aided by the fact that coal, particularly when freshly mined and when in a fine state of division, has a strong affinity for oxygen. The oxygen is

absorbed much as water is taken up by a sponge. This may be considered as the first stage of oxidation. This supplies the oxygen needed for the oxidation of the pyrite and then of the carbon and hydrogen. This action is not likely to occur until a temperature of about 250° F. is reached. The temperature of the coal is raised by these processes until it reaches a point, about 450° F., where the action is autogenous and is no longer dependent upon external sources of heat to maintain the temperature. When the temperature mounts up to about 750° F. the coal takes fire or will inflame.

It must be kept in mind that, paradoxical as it may seem,

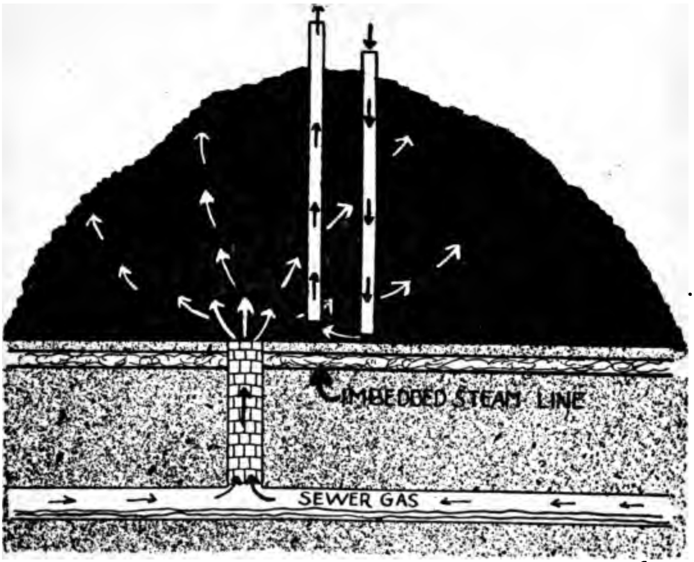


FIG. 3.

small amounts of moisture assist in the oxidation of the coal. This fact was referred to above in connection with the oxidation of pyrite. This was tested out by Professor Parr at the University of Illinois—Bulletin No. 46, "The Spontaneous Combustion of Coal," and the results of his experiments show "without exception, in all the series of tests, the wetting of the coal increased the activity as shown by the ultimate temperature." Thus, when a storage pile is burning, it must be flooded with

water to extinguish it. Merely wetting the surface or outer layers of coal with a hose or spray may hasten the loss it seeks to avert.

The effect of external sources of heat (Figure 2 and 3) is of extreme importance in connection with piles of coal in storage. Without the aid of heat from some external source the initial stages of oxidation either would not occur or their rate would be extremely slow. These sources may be steam pipes in the ground or near the pile, as in conduits, etc., which are in contact with the coal, or the heat from boilers; this last is particularly true in the case of bunkers on vessels. In one case which came under observation, a pile of coal which ordinarily stores without trouble ignited. The cause for this was finally discovered in the presence of a manhole covered with a thin layer of earth, and so overlooked, through which steam passed. This manhole was situated immediately under the pile of coal and was the means of supplying enough heat to start the oxidation of this coal.

When coal is unloaded by dumping onto the ground from a car on a high trestle, and then piling the coal up to almost the level of the car floor, as is frequently done in the coal yards, etc., the breakage causing an additional accumulation of fine coal may be the cause of danger.

The loss in heat value from storing coal is really much less than is generally thought. Experiments conducted by Prof. S. W. Parr of the University of Illinois show a loss of only three to three and and a half per cent for screenings, and also that coals vary to some extent in this respect. The southern Illinois coals show less change than those from central Illinois. The greatest amount of loss usually is during the first six to ten weeks of storage and after that time the change is more gradual.

EXTERNAL HEAT.

The appearance of the exterior of a pile of coal in storage very often gives an impression that there has been a mighty change in quality. Frequently there is a white coating. This is usually only skin deep and known as sulphate of iron. It may also have a rusty or dirty appearance. This discolor is usually only on the outside of the pile while the interior has the natural appearance with the exception of certain slack or fine coals.

Coal will disintegrate under the influence of oxygen and the larger pieces will break up. In fact, the recommendation has been made that coal a size larger than that ordinarily burned at the particular plant should be stored, so that, when the storage coal is burned, it would not be of too fine a size to use.

AVOIDING DANGERS.

All this discussion of the effects of oxidation leads to a

consideration of some of the precautions to be taken to prevent them or at least minimize them. One scheme used in this connection had the opposite result. This consisted of two perforated pipes placed down in the pile. (Figure 3.) The idea evidently was to ventilate the interior and to provide for the escape of heat, should it be generated. However, one of the pipes, which happened to be about two feet higher than the other acted as a stack, while the lower pipe served as an intake for fresh air. The course of the air current was readily demonstrated by blowing the smoke from a lighted cigarette across the top of each pipe. The odor of the coal gas and of the prod-

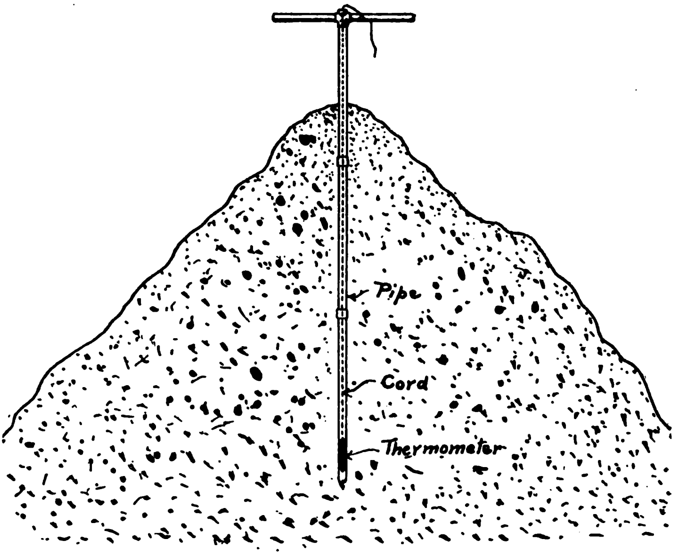


FIG. 4.

ucts of combustion was clearly perceptible at the top of the higher pipe. Thus, what was intended to check combustion, was really furthering the oxidation of the coal.

In conclusion, the safest precautions to take are as follows:

1. Avoid external sources of heat which may in any way contribute toward increasing the temperature of the mass of coal.

2. Eliminate coal dust and fine coal as far as possible.

3. Store dry coal and keep it dry.

These three recommendations are among those mentioned by Professor Parr in his Bulletin No. 46, mentioned above.

4. Put the coal on the ground in a dry clean place, on as clear and cool a day as possible.

5. Do not pile the coal too high. Shallow piles afford the best chance for the escape of the heat from the interior.

6. Store as large a size coal as possible.

7. Store under water, if possible, and be sure the coal is completely submerged.

8. Watch the interior temperature of the pile with a thermometer (Figure 4), and as soon as any abnormal rise in temperature occurs, mark that spot as the next one to be drawn on for fuel, or, if the conditions seem serious, overhaul the pile at that point and flood it.

STORAGE OF BITUMINOUS COAL.

New Hazard Created by Large Supplies—Conditions of Storage Important—Rate Problems.

By William Vlactros, of Philadelphia, Company Inspector.

The exact chemical constitution of bituminous coal is unknown. It is intensely complex. We know, of course, that coals from the same fields vary quite widely, especially in their oxygen and sulphur contents. The chief objection from our standpoint to bituminous coal is its liability to ignite spontaneously. Still, this hazard has been decidedly over-emphasized. Soft coal is easily ignited and quite often fires caused by locomotive sparks, oily waste, tramps, steam pipes, etc., in other words, fires from extraneous causes, are charged up against spontaneous combustion. It is human nature to blame an irresistible agency for all our troubles, which is all the easier done since a fire generally destroys the evidence of its origin.

The cause of spontaneous combustion in bituminous coal is unknown. It was formerly believed to be related to a high sulphur percentage or it was blamed on the pyrites in the coal. We are now more apt to emphasize the undesirability of a high oxygen content, but nothing definite has been established. Piling coal to a considerable height, say fifty feet, used to be considered an excellent inducement to spontaneous combustion; in fact, some insisted that coal should not be piled higher than eight or ten feet, but this is also now an exploded theory, although, to be sure, the higher the coal pile the longer it takes to control the fire by moving the coal out of harm's way.

Practical experience has taught us that bituminous coal (a poor heat conductor) maintains in the storage piles the temperature at which it was piled. For example, during July or August, with the freshly mined coal confined for days and weeks in steel cars too hot to be touched by bare hands, and this hot coal piled afterward in the full glare of a mid-summer's sun, we will find that the coal pile from top to bottom will maintain for months a temperature of 90 degrees to 100 degrees F. If this warm coal is piled in the open and is occasionally dampened by a thunder shower, it heats up quite noticeably and may ignite. In this section of the country some people used to consider Southern coal more hazardous than Pennsylvania coal, but experience has proven that such generalizations will not do, and under equal conditions there are no reasons for such broad assertions.

The physical condition of the coal should be the main consideration. Of course it must not possess too high a latent heat, and it must be dry and above all it must not be too finely broken up. In other words, "lump" coal is the safest, and screenings are the worst. Under present conditions, though, we will find mostly unscreened or "run of the mine" coal, and this class of coal, especially when freshly mined, will heat spontaneously. Spontaneous combustion of bituminous coal generally occurs within three to six months of the time it was mined, and coal stored for a year can be considered fairly safe or "seasoned." We used to have great faith in "ventilation," but "thorough" ventilation of "run of the mine" coal is impracticable, and poor or insufficient ventilation only increases the danger of spontaneous combustion. When fires occur no attempt should be made to use water unless it is available in tremendous quantities. Insufficient water, especially inside of buildings, may cause serious explosions. The best way to handle a bituminous coal fire is to remove the pile as quickly as possible and spread the coal out on the ground in very thin layers.

In issuing policies on bituminous coal the following points are worth ascertaining: (1) In how many distinct piles is the coal stored? The more piles the better. (2) How many tons in each pile? Two hundred tons is plenty for one pile. (3) How far are the piles apart? They should be at least twelve feet apart. (4) How quickly can the coal be moved in case of heating? Are cranes with clamshell buckets available or is dependence placed on manual labor? (5) When was this coal piled? If piled during extreme mid-summer heat, considerable caution is necessary. (6) Is the temperature of the coal taken regularly? This can be done readily by driving two or three inch iron pipes into the piles in which an armored thermometer is lowered. When the temperature reaches 150 degrees F. remove the coal at once. (7) Is this coal roofed over? Coal in the open is, of course, less desirable than coal that is roofed over. Alternate dampening by rain and drying by sun and wind is quite undesirable. If the coal is roofed over, the storage building should, of course, he adequately ventilated. (8) Are the coal piles exposed by railroads, or what are the exposures? (9) Is the coal under constant supervision? Is the yard fenced in? Is the building kept locked? I have found large coal piles in remote locations beyond all supervision. (10) Is the coal piled on "dry" ground? The drier the location the better.

The spontaneous combustion clause is a delusion and a snare for which we should not make a substantial rate concession. How are we to prove that the fire was started by spontaneous combustion? Quite contrary to general belief, spontaneous combustion does not always start in the bottom of the pile, but *is likely to start anywhere.* I dug into a coal pile which was

practically on fire four feet below the top, but was quite cold ten feet lower down. In short, by attaching the spontaneous combustion clause we simply reduce our premium income without obtaining any compensating advantage.

The rate obtained should also remunerate us for the enormously increased cost in salvaging coal owing to the high cost of labor. In bulky low-priced material like coal there is always an abnormal relation between the cost of salvaging and the value of the salvaged material. To be sure, the increased cost of coal brings us an increased premium income, but even this is insufficient, particularly when we consider that time and again under present conditions we will pay a total loss because no labor was obtainable at any price. You know, moving heated or half-burning coal is not a job any one would tackle for his health. I distinctly recall a case where two score of men were overcome by gas fumes when loading a tramp steamer with coal which had been too long in steel cars in the hot summer sun.

There is another important aspect to the writing of bituminous coal on storage. We must not forget that these accumulations of potential energy are stored to assure "the steady output of war materials." Only one thing really matters now: "Winning the war." We fire insurance men are good patriots and cannot afford to refuse protection for these bituminous coal accumulations. Of course, we do maintain the inalienable right to charge a fair rate for the risk incurred, and it is nothing less than our plain duty to point out to the assured how to safeguard his coal while stored. Practical experience has convinced me that the hazard involved in the indiscriminate storage of bituminous coal is an absolutely new subject to the great majority of the assured.

Incidentally, when we find hundreds of tons of bituminous coal piled against an insured building, we are most assuredly entitled to a stiff exposure charge. I recall one recent case where the space between a six-track main railroad and a large frame storehouse ($250,000 fire insurance) was filled in to a height of twenty-odd feet with freshly mined bituminous coal.

AMMONIA REFRIGERATING MACHINERY

Protection from Hazards of Explosion—Lessons from a Typical Fire.

A report issued December 26, 1918, by the New York Board of Fire Underwriters and the New York Fire Insurance Exchange on an ammonia explosion in a compressor room, May 11, 1918, of the Merchants Refrigerating Company, Tenth and Eleventh Avenues and 16th and 17th Streets, New York City, gives valuable suggestions for safeguarding this hazard as follows:

One of the 225-ton ammonia compressors was in operation on the evening of the accident. The construction of the plant was completed, except for the hanging of a few doors on the lower floors and testing the automatic sprinkler and refrigerating systems. The chief engineer of the plant, with an assistant engineer and two oilers were in the engine room in the vicinity of the 225-ton compressor which was in operation at the time of the accident. Apparently a bolt on the bearing of the connecting rod at the crank shaft broke which caused a disarrangement in the crank case. The compressor which had been turning at 208 r.p.m. stopped instantly and the water jacketted cylinder was wrecked. The centrifugal force of the fly wheel caused it to break up into numerous pieces, which tore down pipes in their path, also gouged several holes in reinforced gravel concrete columns to a depth of 2 inches. The building columns were in the plane of projection of the fly wheel and this prevented the flying parts from doing extensive damage to other machinery. The engine room immediately filled with ammonia gas and the employees of the engine force, who escaped, were almost suffocated from the fumes. A fire alarm was sent in immediately after the accident at 7.02 P.M. On arrival the commanding officer immediately sent for the rescue company as it was impossible to get near the building, owing to the ammonia fumes escaping from the street windows of the engine room. This call was sent in at 7.06 P.M. The records of the fire department show that no water was played into the building prior to the explosion as there was no evidence of fire. After the rescue company arrived and had adjusted their gas helmets, the chief engineer of the plant offered to show where the main shut-off valves were located. An ammonia helmet was adjusted on the engineer, and as the party was proceeding toward a large door which opens from the condenser room on the first

floor to the street, an explosion with flame occurred which was described as big puff. This was about 27 minutes after the accident to the compressor and was simultaneous with the operation of the circuit breakers in the power house of the United Electric Light & Power Co. This opened the 7,500-volt 3-phase feeder circuit leading directly to the 7,500-volt switch panel of the power company located in the compressor room of the cold storage warehouse. An examination after the accident showed fused copper on the insulated lugs for connecting cables to the 7,500-volt oil switches. These lugs are separated about 8 inches and the explosion of the ammonia vapor was apparently due to an arc between these terminal lugs, resulting from a reduction of the insulation presumably caused by the protracted discharge of ammonia vapor, assisted by the simultaneous discharge of water into the room from the supply to the cooling jackets of the compressor. Firemen who were standing at the curb line, also members of the rescue squad, were thrown down or hurled across the street and a number were severely injured or burned. Some of the firemen were thrown against their wagons and others against a barbed wire fence located in front of piers, a distance of about 50 feet. The door of the stair shaft to the engine room was open, and the explosion went up the shaft, also through an unprotected opening at the bottom of the pipe shafts, and blew some of the shaft doors to upper floors open and others off their hinges. A 4-inch tile enclosure at the first floor over the stairs from the engine room to the condenser room was demolished. A large wooden door, through which the rescue squad was about to pass, was blown across the street, also the engine room windows with parts of the sash and a number of windows on the first floor were blown out. The wooden sash and frames of the engine room, also the pitch coating on the cork insulation around brine pipes in the pipe shaft and engine room immediately caught fire.

SPRINKLERS IN PROCESS.

The fire department, who already had their hose lines stretched, turned water on the fire immediately after the explosion, also sent in second and third alarms at 7.29 and 7.32 P.M. respectively. They connected to the emergency device at the street and emptied the ammonia from the system into the sewer. Brine pipes in the pipe shaft were insulated with 3 inches of cork, painted with pitch to protect from moisture. The pitch coating caught fire after the explosion and in some places the cork was charred through to the steel pipe. The firemen used the hose on the standpipe to extinguish the fire in the pipe shaft. Considerable water was thrown in the building for the reason that the firemen were afraid of another explosion as the ammonia fumes became dense again after the explosion, also the pitch on cork

was burning and resulted in dense smoke rising through the pipe and stair shafts. There was approximately 18 inches of water on basement floor at one time.

The building is equipped with automatic sprinklers, but as the system was still in the course of installation, it did not figure in the extinguishment of the fire, nor was the system used by the fire department. Seven sprinklers inside and nine sprinklers outside of main office on first floor and one sprinkler on mezzanine ceiling were either fused by the excessive heat or ruptured by force of the explosion. One sprinkler in chill room on tenth floor immediately opposite doorway was fused, as evidenced by the condition of the links and blackened wall in room at doorway.

The ammonia compressor in which the break occurred was practically wrecked. The casting of the rotor in the motor was cracked and piping in the vicinity of the broken fly wheel was flattened or badly broken, also several holes were gouged in nearby reinforced gravel concrete building columns to a depth of 2 inches and in one place the reinforcing members were exposed. The subsequent explosion of ammonia did considerable damage. It blew a number of doors off hinges from the stair shaft, also from the pipe shaft and in some places ⅜-inch hinge bolts were sheared off. Cork insulation around brine pipes was covered with pitch and in some places was charred through to the pipe. The insulation of large electric cables in the pipe shaft was also badly carbonized, and in some places nothing but white powder or bare copper wire remained. A few planks in the pipe shaft, which were used by workmen, were practically consumed. A number of hose lengths on the standpipe in stair shaft were also burned. Office partitions and furniture on the first floor showed signs of heat as the paint was blistered. All of the engine room windows were blown out and the wood window frames and sash were burned, also practically all doors and windows at the office and condenser room were cracked or blown out.

In addition to the fused sprinklers an examination shows the sprinkler equipment was affected only in "A" shaft, in which controlling valves, dry valves with auxiliary and alarm attachments for the sprinkler system in Section "A" are located. The rubber gaskets at flange connections are charred and will have to be replaced; auxiliary attachments on dry valves are badly damaged and will also have to be replaced, as well as alarm devices and wiring for both local and supervisory systems. Otherwise, the sprinkler equipment appears to be intact, but it will be necessary to examine each sprinkler and test out each system in Section "A" before placing in commission.

The damage by fire to the refrigerating plant was $9,342; the *building and other* equipment was similarly damaged $36,411.

The original accident is said to have caused a damage of about $40,000 in addition to the damage by fire.

Credit is due the owners for the promptness with which the refrigerating plant was restored, so that the process of refrigeration was interfered with only in a very slight degree, if at all. This undoubtedly prevented a heavy loss to contents of the cold storage rooms.

SUGGESTED PROTECTION.

This and previous explosions as well as laboratory tests show that pure ammonia vapors mixed with air in certain proportions will explode if ignited. For practical purposes it is immaterial whether the chemical explanation attributes the explosion to hydrogen gas liberated by a decomposition of ammonia, or to some other cause.

All exposed fire and flame must therefore be excluded from the ammonia refrigerating machinery rooms and other places subject to the accidental discharge of large quantities of ammonia.

The spark which caused the explosion of ammonia vapor in this case was apparently due to an electric arc established between two bare metal terminal lugs of a 7,500-volt oil switch. A space of 8 inches across a slate surface formed the insulation between the terminals. This insulation seems to have been reduced sufficiently by the moisture laden vapors resulting from the discharge of ammonia and cooling jacket water to establish an arc between the terminals as evidenced later by fused copper thereon.

An insulating covering is therefore considered essential, for all live metal parts of every electrical equipment having a potential in excess of 600 volts.

All electrical equipment not essential to the ammonia refrigerating machinery room should be separated therefrom and consideration should be given to the advisability of preparing special requirements for the electrical equipment in ammonia refrigerating machinery rooms.

There should be a service switch controlling all the electrical equipment in a refrigerating machinery room; this switch should be outside of the room and located where it can be safely reached and opened in case of an accidental discharge of ammonia.

THE GRAIN ELEVATOR.*

A Prolific Source of Fires and Explosions.

By B. W. Dedrick, Professor Mill Engineering, State College, Pa.

Elevators, particularly the heads, have been in the past prolific sources of fire. The old-style elevator head, with the straight-across bottom, just a half-inch or so under the lower side of pulley, was especially dangerous, because it was a gathering place for dust, the face of pulley actually touching and turning in this compact dust. Many mills and elevators have been destroyed in that way, and undoubtedly many of the mysterious fires and explosions had their origin in the elevator heads. It is possible also that by a displacement of a leg the belt may rub or bear continuously against one side of a leg for a considerable distance and eventually cause a fire. Other sources of fire are the belt rubbing at the boot, the pulley bearing against the boot, the bearing running dry and igniting the wooden side of boot, or starting a fire by means of gathered dust.

It is probable that in eight out of every ten fires that have their origin in elevators the source or point of origin is the head. There are various causes. There may be a single cause or factor or a combination of causes which starts the blaze.

ELEVATORS HANDLING GRAIN

are particularly susceptible and dangerous as sources of fire, the grain dust which gathers in the heads at any point where it can lodge becomes very light, powdery and dry, and being rather loose or free in character, readily ignites, and, if in any bulk, will burn at the first like punk, or tinder. If there is any current of air to fan it, it burns very rapidly and soon becomes a mass of live coals, either setting fire to the wood in contact with it or finally bursting into a flame itself.

Often the fire starts some hours after the elevator ceases to run, apparently lying dormant or smoldering until sufficient heat

*There have been many grain elevators, mills and warehouses destroyed in the past year by fires and explosions under circumstances warranting the conclusion that they were not caused by or the result of accident or neglect, but by design on the part of persons influenced by German propaganda to prevent our sending over grain, flour and food to our allies on the other side, or to cripple our own resources; hence the need of all the more watchfulness in the care and operation of the plants, and guarding them from destruction by incendiarism, as well as the fires caused by *faulty construction*, machinery or negligence.

is generated to start the blaze, or a fire is started at the boot by some coals or burning dust dropping down the leg.

Cases have occurred where fires started simultaneously at the top and bottom, or, rather, in attic and basement of mills and elevators.

If the elevator shaft is out of level or line, it may cause the pulley to rub against the sides of the head, and, of course, the belt also, and the shaft may bear and make a seat for itself on the bottom or side of a hole in the head. The

HOLES IN THE HEAD

through which the shaft passes are frequently but little larger than the shaft, leaving a scant margin of opening around the shaft, and, should the bearings become sufficiently worn, the shaft will rest and turn against a dry surface, and while elevator shafts turn slowly, yet, the constant weight, sometimes considerable, and the friction kept up unceasingly for days at a time ultimately generate sufficient heat to char or set fire to the woodwork, or, perchance, dust adjacent to the shaft. Another cause is the settling down of the elevator and bringing the head to bear on the shaft. This may be caused by the settlement of some lower floor upon which the bottom or boot of the elevator rests, or by a sagging of a door or support under some particular elevator or certain elevators in the line, as in a mill, the others being unaffected.

The settlement may be permanent or variable, caused by the alteration of floors due to the intermittent loading and unloading of bins, and to the storage of flour, bags of wheat or other material on the floors.

Again, if the elevators rest on a good solid basement floor, they will stand solid and not settle. It may then be the elevator shaft that comes down with the gradual settlement of the building or floor that carries or supports the bearings. If the elevator is not plumb, the belt is sure to rub along one of the sides.

The upper part of a section of the elevator head may become displaced or cocked over to one side, thus allowing the pulley to bear or run against some portion of the head.

IMPROPER SPEEDS

or defective discharge are sources of danger because of the liability of clogging down the elevator, and also because of blowing of dust, which may be sufficient to cause an explosion on contact with an open light, or even sparks generated by static electricity. When an elevator becomes clogged and chokes down, it is only a question of time when a fire will be started, unless the trouble is relieved, or the machinery stopped before the danger point is reached.

When the elevator chokes down or the belt is stopped by reason of something getting into the elevator and lodging at the bottom of the boot and wedging between bucket and bottom, or a bucket gets bent out, or becomes loosened and digs into the bottom or sides of the elevator, the pulley, if there is sufficient power, keeps turning and the friction evolved by the pulley against the stationary belt, soon generates sufficient heat to make the pulley and belt unbearable to the hand. If this continues running for any length of time the belt is likely to be burned in two and to set fire to the head and any dust gathered within the head. The belt then gives way, and both ends drop back and down the legs for a certain distance and jam. The burning ends drop sparks down the legs to the bottom and also afford the means of starting fire at the points where the ends lodge. The clinging dust within the elevator, thus disturbed and set free, may explode.

DANGEROUS PRACTICES.

It is bad practice to open up the door or lid of an elevator (more particularly if carrying floury material) that is clogged at the head, with the stock going down the back leg, because, in addition to causing blowing, the buckets are overloaded and carry up the material much like a chain pump, and at the point of the open door spill or shoot out the stock onto the floor, usually three or four feet below, causing a great dust to arise and float and spread throughout the mill, and if there is an open light or a lantern in the vicinity, explosion and fire are almost certain to result. The explosion may not be very serious and may be confined to a limited area, and do no particular damage; but on the other hand, if the conditions or elements are just right, it may be very disastrous, as the first or primary explosion may be powerful enough to jar down dust lodged on that floor or other parts of the building, and cause a secondary explosion, the blast of which wrecks the building and snuffs out the lives of the workmen.

A number of elevators may be strung along or nested between two bearings rather far apart. It sometimes happens that a shaft is not large or stiff enough to resist springing or bending because of the weight of the pulleys and the strain put upon the shaft by the tightening of the elevator belts and the loads which they carry. The result is that the shaft bears in the holes in the elevator head, particularly in those situated near the center between the two bearings.

HOT SHAFTS.

The shaft often becomes very hot and will start a fire. Moreover, while it is possible for one or two elevators in the center of the line to run fairly well, that is, the belt running full upon

the pulley, the belts of the elevators on either side of the center will run more or less to one side of the pulley in the direction of the spring or bend, and rub against the head. This can be easily remedied by placing a bearing in the center, between two contiguous elevators, using the elevators themselves as the supports. The writer has made use of maple blocks for such a bearing, which answered the purpose admirably, as frequently the space was so contracted that an ordinary iron boxbearing could not be used. The elevator belts were loosened, allowing the shaft to spring back in place, which was then leveled. Cross pieces were fastened to the elevators, and then strips under these reaching down and bearing on the floor nailed to the leg as additional supports. The bearing was mounted on a small beam supported by the cross pieces. This is a method that could be adopted in which all the bearings of an elevator line shaft could be mounted and supported, making the elevator and its shaft self-contained, with the possible exception of the drive end bearing, which, however, could be mounted on posts supported by the same floor. The upper or attic floor, which contains the heads of the line of elevators, is generally free of any heavy machinery or carrying loads subject to change, as there are no bins to be filled or drawn from; hence the load is constant, and not like the floor below, or others below this that perhaps carry bins and other loads that are continuously changing except, of course, in the modern constructed concrete mill or elevator building.

STRUCTURAL POINTS.

The line of elevators including the shaft, being carried and supported by the upper floor would not be subject to the alteration or settlement of the lower floors, which may vary more or less in different parts or bays, affected by changing bin loads or other forms of storage, in that quarter.

Each elevator should be carried by the floor by nailing or screwing strips or cleats eight or nine inches long and of the same width as the legs to both the front or ascending leg and the back or descending leg, on both the rear and front of each leg. The lower end of these cleats or supporting strips would rest upon the floor, the upper end being nicely beveled. These strips may be an inch thick for the ordinary size elevator, and rest on a reinforcing plate or strip laid on the floor and along the line of the elevator to give greater supporting force and to distribute the load more evenly should the floor be for any reason weak at the ends next to the elevator.

The legs extending down and through the lower floors should have a slight clearance all around them at the floor line so as not to be pinched and affected by any movement of these floors.

The boots landing on any of these floors should, if carried

down to the floor line, not rest on the floor, but have some clearance, more particularly if this floor is subject to changes.

It would be better practice to have every elevator boot that must come down near the floor placed so that the bottom is at least six inches above the floor, if for no other reason than that it is more clean, sanitary and economical. In case of a choke-up, necessitating relief by drawing the slides in the boot, stock can be caught in a box made for the purpose and no loss or litter ensue; besides the stock is thus kept clean, and all can be utilized, whereas if it is picked up from the floor, some loss is sure to occur, because, after picking up the bulk and skimming down to the floor, the remainder, even if brushed up carefully, is apt to be contaminated by floor litter or dust, and will perhaps be thrown into the feed pile.

Elevators that extend down to the basement should at least have the boot some distance from the floor for this reason. The boots can be, if it is the intention to have the basement floor as the landing for the elevator line, supported on a stout frame or truss that rests on the floor, the legs of this frame so disposed as not to interfere with the sliding of a box under the elevator boot in case of a choke-up, and its relief at the bottom. This keeps the bottom of boots and any stock therein free from dampness and must.

FLOOR SUPPORT.

The basement floor, especially if of brick or concrete, will afford a solid and unchanging support for the elevator line, providing the legs are clear of all other floors. However, the shaft may be susceptible of changes due to the settlement of the walls or the supporting floor, and in time causes trouble.

It is hardly necessary to suggest the remedies, for the pointing out of these dangers and their causes thus known, are themselves suggestive of their application. If there is trouble, find the cause, then remedy it. Don't procrastinate.* We are having altogether too many fires and explosions in mills, cereal plants and elevators.

Although these are abnormal times, and the mills and elevators are in many instances rushed, there should be no let-up on the exercise of vigilance and great care on the part of those operating elevators, mills and cereal plants, and when there are certain troubles or evils known to exist in connection with elevators, as has been pointed out, investigate, then get busy.

NEGLECTED OILING.

The oiling of elevator shaft bearings is often neglected, because, as a rule, the bearings are not easily accessible, it being *perhaps necessary to* climb a ladder, and, as the shafts are run

very slowly compared to some of the other machines, the operative or oiler, is apt to think that there is no particular harm if they are not oiled every day, and to let them go for a week or two at a time, and sometimes longer. This remark only applies to the old-fashioned plain babbit or wooden bearing, and not the self-oiling types, which require only periodical oiling or renewal of the oil in the reservoir. But these, too, are often neglected. The elevator shaft, or rather bearing, can become very warm, even hot, if run dry continuously for a long time.

The heads and bearings of elevators ought to be easy of access, so that they will not be neglected or overlooked, as is apt to be the case when they are difficult, even dangerous, of access.

A GALLERY

or running board should be provided and placed on the discharge side of the elevator at the head, and a hand rail attached. This should be reached by a ladder or step. This floor or gallery provides not only the means or reaching and oiling the bearing, but of readily examining the head and interior, and for easier work in case of relieving a choke. Sometimes strings pile up on the tongue above the throat and interfere with a free discharge and some material drops down the back leg, causing more or less "blowing" and dust to issue from elevator or connecting spout.

Easy access to the head of any elevator, or in fact any machine, invites frequent inspection, and investigation and correction when things go wrong.

The journals at the boot of elevator are perhaps the most neglected of any bearings in a mill, so far as regular oiling is concerned. Sometimes the boots are so close together that it is very difficult, if not impossible, to oil them in the ordinary way; the holes, too, get plugged with dirt, and the oiler passes by with the intention of oiling them some other time; this "time" finally running into weeks or months, perhaps a year, before they get a drop of oil.

AEROPLANE MANUFACTURING.

Hazards of Great New Industry in the United States—Types of Machines Described—Fire Guards for Buildings and Processes.

By S. T. Skirrow, Insurance Engineer.

War has brought to the insurance business a great many new industries with their consequent hazards. One of the most important of these is the manufacturing of aeroplanes, which, to use a common term, has "overnight" sprung into an enormous business.

Only a few years ago a factory for the exclusive manufacturing of aeroplanes was a rare thing, although numerous experimenters made models, and even occasional machines, in a corner of some building.

As soon as the United States entered into the world war, it was seen by those directing the policy of the country that the aeroplane was destined to serve a very important part in the war and immediately Congress authorized an expenditure of $640,000,000 for the equipment of a fleet of aeroplanes. This, of course, gave a tremendous impetus to the business. Now entire buildings, employing thousands of men, are at work making these machines, which have passed from the experimental stage to a tried and proved product. Many factories are being built and old ones enlarged, and the business generally is booming.

FUTURE OF THE AEROPLANE.

No one can predict what the future value of the aeroplane will be, but we do know that the experience of the war has made aviation what it is to-day and as it is a known fact that we will not retrogress, air service is bound to become a fixed and permanent thing. This, of course, will bring many new problems to the country, such as air traffic rules, landing stations, etc., and there will, undoubtedly, be many improvements in the types of machines and the stability with which they will fly.

TYPES OF MACHINES AND THEIR DUTIES.

It may not be generally known what the types and duties of the aeroplanes are. Therefore, I will undertake to give a brief outline. It is their purpose to combat and destroy hostile aeroplanes, thereby blinding the enemy, also opening the eyes of our

forces by keeping them informed as to movements of troops, supplies, bringing up of artillery and placements of guns. By use of signals, our aviators inform the artillery as to the effectiveness of their firing, thereby enabling the officers to correct the range of their guns. The machines are also used for taking photographs of trenches and enemy territory and bombing. The latter is usually done at night. A striking contrast in machines is shown on the front page of this issue. At the present time on the fighting line, there are the following types in use:

RECONNAISSANCE—Directs firing and leads infantry, by signal lights and radio telegraphy.

COMBAT—Protects the reconnaissance machine and chases enemy aeroplanes from our lines. Is used as an offensive machine.

©*Photo by Capt. Lamberto Vanutelli*

IDEAL HANGAR.

Showing a large, glass, steel and concrete hangar being part of a factory in a European country. This is the type of building insurance men would like to see built at all plants. The aeroplane is of the reconnaissance type.

PURSUIT—Is used for defensive purposes and gets its name from its driving qualities.

BOMBING—Is used at night for bombing enemy positions, supply depots, etc., and more recently by our Allies as a reprisal measure.

All but the bombing machines carry about 700 pounds' weight and are capable of making from 110 to 180 miles per hour.

The bombing machines are much larger and capable of carrying 4,400 pounds, but are only able to make a speed of 80 miles per hour.

At the beginning of the war, we had approximately 150 aeroplanes, suitable only for training purposes. This country's needs in aeroplanes will probably be limited to the following:

TRAINING MACHINES—Low powered, 100 to 125 horse-power, 4 or 8 cylinder machines, small, and used for training purposes exclusively.

ADVANCED TRAINING MACHINES—Are similar to the above, except they are much more agile.

BATTLE PLANES—Are used for three separate purposes,—reconnaissance, combat and bombing. They carry two men, one seated in front to guide and manage the operating of the front machine gun, and the other in the rear to operate the rear machine gun, bombing, drawing maps and taking pictures.

HEAVY BOMBING PLANES—Are larger and heavier than the ordinary type. Carry greater loads, therefore, slower. Usually for night bombing.

UNDERWRITING.

Many underwriters have been asked to accept liability on aeroplane factories, but the absolute newness of the business made it difficult to determine the size of the line to be carried, because there were no definite figures to show how profitable to the insurance company the business may be as a class. In other words, the number of factories were too few to obtain an average basis to work on.

TYPE OF BUILDINGS.

Generally aeroplane factories are located in outskirts of cities where there can be had plenty of ground area at low cost, because the very size of an aeroplane calls for considerable space especially where a great number are manufactured.

Because of the numerous rush orders received by the various companies it will usually be found that many concerns have not built new and up-to-date factories but have seized whatever available property could be found. As a rule, many old one- and two-story vacant or idle plants have been adapted and the construction on the whole is poor. A bad feature is that no sooner are these old plants taken over than large area extensions of frame, metal or terra cotta are immediately added, thus making enormous unbroken areas of flimsy construction. Sometimes these extensions are so added to complete a communication and make one building out of numerous detached buildings. At times I have even seen tents erected to house some of the materials owing to the lack of storage space in buildings.

Construction generally may be found all frame, metal on wood framework, terra cotta, which is little better than frame, or brick walls with joisted wood floors, or with steel supports for wood floors and roof. Some buildings may be steel frame work with wood roof and with curtain walls of terra cotta, concrete or brick. The absolute fireproof building, such as reinforced concrete or steel covered with concrete and with concrete on brick walls, does not seem to be as prevalent here as they are in Europe.

I would not attempt to give a uniform standard for construction, but wherever possible buildings should be of fire resistive construction. Of course the area must be large and it would be desirable to have the plant separated by fire walls into sec-

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LARGE AREAS NECESSARY.

This picture shows a common type of construction. The presence of this immense hydroplane (an aeroplane with a boat-like body and pontoons under ends of wings used for rising from and landing on surface of water) illustrates why large unbroken areas are necessary.

tions so as to limit the liability of total destruction. Openings through walls should be protected by fire doors. If the openings be very large a rolling steel fire shutter arranged to close automatically would hold a fire back for a while. All floor openings should be protected by at least eight inches of brick with fire doors at openings. Belt holes and openings around shafts should be reduced to the minimum and boxed. Skylights where above shafts should be thin glass on metal with stout wire screens

above and wire glass on metal where over other parts of roof. The covering of roof should be tin or an approved composition.

If temporary buildings must be hastily constructed it would be preferable to have as little combustible material as possible in their construction.

For "Ideal" building construction of the various types, i. e., fireproof, ordinary, etc., see "Stables," Live Articles on Special Hazards No. 9.

HANGARS.

These are merely storage sheds for aircraft. They are to the aeroplane what a garage is to an automobile. They are rapidly multiplying throughout the country and are built of all sorts of materials. The prevailing construction, or rather more desirable, is sheet metal, concrete and steel and glass. The hazards resemble gasolene motor repair shops but maye be just as severe as an aeroplane factory when much repairing to wings, frames, etc., is done.

MATERIALS AND SUPPLIES.

Various fittings and materials come from widely separated factories and are shipped to the plants for assembling and wiring by highly specialized workmen. Increased demands called for ingenuity on the part of engineers to supply necessities in the limited time. The booming of the business has created demands for materials for the business not used so much heretofore, and this has caused a serious shortage of these materials, making it necessary to find ways to assist the process of nature in preparing materials and to find substitutes. This is illustrated by the shortage of spruce wood which was overcome in a manner which will be explained later.

ACETONE—Used in the dope, suddenly became scarce. It is used in the manufacture of cordite, a high explosive, and is a derivative of acetate of lime obtained in various ways, principally in the distillation of wood. It also can be obtained from the black liquor of the paper making process, from sawdust and from vegetable matter.

CASTOR OIL—All other lubricating oils when used in aeroplane motors scorch and become burned. It became necessary to obtain an increased production of this oil which is ideal for lubricating purposes.

MOTORS—Practically all motors are made in factories separate from aeroplane plants. It is a work calling for great skill and accuracy. The buildings in which they are manufactured are similar to automobile engine factories, taking of the machine shop hazards. The engines are from 150 to 300 horsepower and to show what care must be exercised in their manufacture, their weight per horse-power is about 2 pounds, whereas

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COVERING THE WINGS.
Stitching linen tightly over framework.

an automobile engine weighs approximately 10 pounds per horsepower. The new Liberty motor is to be standardized so parts of one engine may be interchangeable with parts of another engine.

Aeroplane engines must work without skip or jar when upside down, edge ways, side ways or whirling around. They must run at full speed, without overheating, for hours at a time. (Automobile engines rarely run at full speed more than 10 per cent. of the time.) The motor mechanism is thoroughly tested before each machine is assembled and is often taken apart several times to observe wear and strain and put together again before receiving an O. K. The life of these engines is hardly more than 100 hours and continuous substitution of new parts practically remakes it in a period of time. The cost of each engine is considerably more than a fine limousine automobile.

PROCESS OF MANUFACTURE.

Many people think an aeroplane is a simple thing to build—a pair of wings attached to some sort of a body with an engine between and a propeller in front. It is pictured to be a few rough cuttings, a little nailing up and the machine is ready, but such is not the case, because every bit of the work requires extreme care and expert workmanship. Somehow a plane looks very simple and graceful as it floats through the air and we lose all thought of the skill that goes into its making.

In a small machine as many as 1,000 stampings must be cut out, 800 forgings cast and 300 turnbuckles are needed. Each plane has about 3,000 parts and there are more than 2,500 drawings required for a complete aeroplane, exclusive of the motor.

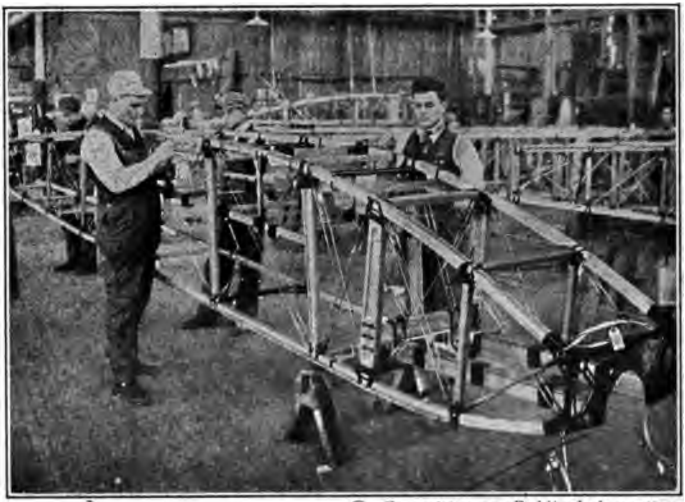
These machines are built to stand enormous strain from wind pressure while flying through the air. All parts must be made light and strong and guy wires kept taut. It has been estimated that in certain movements, i. e., diving, etc., that several tons' pressure is exerted on various parts of the machine.

As little metal as possible must be used in its construction because it is altogether too heavy. It has been tried and found to be unsatisfactory. One hundred and eighty board feet of spruce are needed in making a machine and to get that amount 1,000 feet of free and clear spruce are needed. At present lumbermen are using about 4,000 feet because the quality is not so good as it will be.

Other woods having the required strength are too heavy.

The lumber comes roughly cut along standard lines, then it is further inspected and shaped and reinforced in places of stress and hollowed out in places of extra weight. Keel is laid, then basic wing spars, then ribs as many as 30 to a wing made up of a number of thin (like veneer) wood parts glued and *fastened together,* the theory being that several thin pieces glued

together having a multiplicity of grains are stronger than a stouter piece with single grain. One of the most delicate operations is the making of metal fittings for the fuselage (the body of the car). When finally the ribs are firmly set the wing is nothing but a skeleton. Linen is the one perfect covering because it is light, strong and will not rip as cotton does when pierced by bullets. Practically all linens are imported from Ireland. Silks and combinations of silks and cottons are being tried as substitutes for coverings. One machine requires at least 200 square yards. The linen is cut to size and reinforced in places of stress, then sewed in back and forth over each rib



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BUILDING THE FUSILAGE.

Workmen fastening guys and braces on the fusilage, one of the vital parts in the manufacture.

to make it absolutely tight and able to withstand 150-mile wind-pressure. This work is mostly done by women working in pairs pushing a long three-inch needle from one side to the other.

The body of the car is usually covered with sheet aluminum, motor is installed, tank is large in capacity and seamless, wheels with tires are attached.

After the aeroplane is completed they hang things on it like a Christmas tree. Delicate and expensive instruments such as

revolution indicators, barometers, air speed indicators, an aerial compass, an indinometer and an altimeter. At ascension stations oxygen tanks, cameras, electrically heated suits and machine guns may be attached.

Machines are shipped in sections, the body of the car with truck, engine, etc., is placed in one case and tightly fastened in position. The wings, struts, etc., are placed in another box on edge and clamped in position. These boxes are veritable box cars and strongly constructed and are shipped to various parts of the country.

WOODWORKING.

The woodworking feature is perhaps one of the biggest hazards. There has been considerable difficulty in obtaining the proper kind of wood for use in the construction of the aeroplane. The wood that gives the strength with lightness is spruce, not ordinary spruce, but super selected spruce from giant trees of the Pacific coast. The ideal trees are the old patriarchs, scarce enough at present and which run up to 150 feet and are 15 feet in diameter. Only 48 per cent. of the material in these trees is used. The part at the heart where the grain is too circular and the part at the outside where it is too coarse are useless and before the wood is finally used, perhaps not more than one-third of it is available on account of knots, irregularities in the grain, etc. Of the selected wood, less than 1 per cent. has the necessary strength for *ailerons,* 3 per cent. for wing beams and 5 per cent. for long struts and 5 per cent. for the landing gear. The balance can only be used for ribs and small fittings. There is a tremendous shortage of this wood and the supply is now controlled by the Government.

Seasoning of spruce usually took 18 months from the time the trees were felled. Ways were finally evolved to season it in 4 months and after intensive study and experiment on the part of our engineers, ways were found to season it in from 8 to 14 days by the process of saturation.

Propellers must stand several tons' air pressure. They are made of 10 to 25 pieces of walnut, white oak, mahogany or cocoa wood, all carefully laminated and glued together. It takes 10 weeks to make them, three of which are allowed for the glued parts to thoroughly dry.

Lots of the woodworking is done by hand but many power woodworking machines will be found, such as band saws, circular saws, swing saws, jig saws, routers, jointers, variety machines, planers and lathes. If individual motors operate these machines, they should be set on metal and be in dust tight housings. There should be a blower system installed, having a pipe connected to each machine so as to remove the accumulation of wood refuse as fast as it is made. The pipes of this blower

system should not pierce a floor and where extending over more than one floor of a building should connect to a riser located on the outside wall of the building. The cyclone dust separator should be installed on the roof or at a distance from the building and deposit the refuse into a standard shaving vault. A standard shaving vault should have brick walls 8 inches thick with a wire-proof roof and be without communication to the boiler house or any other building.

GLUING AND DRYING.

A great deal of gluing and drying of parts in caul boxes is done on the premises. Glue should be heated by steam and

IN THE SHOP.
Fitting and fastening parts of a wing.

at no time by direct flame. The writer has often found large kettles of glue sitting on two or three burner gas stoves, which in turn were on wood tables or shelves. The concentration of heat under these kettles has been severe enough to char the wood shelf or table to a depth of half an inch and place it in a condition likely to burst into flame at any minute.

Caul boxes should be steam heated and preferably be all metal construction, but this is almost too much to expect when

most all of those found are entirely of wood and unlined. The wood is so dry that it might almost fall apart. Certainly it could kindle a great fire.

Particular attention should be paid to the distance steam pipes are from wood and whether or not articles for drying rest on the steam pipes. Wood dry boxes should be lined with metal lock-jointed and blind nailed, steam pipes kept one inch from woodwork and metal racks provided to keep contents from coming in contact with the pipes. Heating of caul boxes by passing smoke pipe of coal stoves through them is "taboo."

Kilns are usually brick buildings with wood roof and lumbers in them generally rests direct on steam pipes. The roof and beams should be non-combustible and stout steel racks should keep lumber from contact with the steam pipes.

Steam pipes throughout the entire building should have woodwork cut away one inch from them.

Ovens for drying lacquered or japanned goods should be all metal construction and have a vent to the outer air to carry off explosive vapors. Heating should be by steam or electricity, but where gas must be used the flame should be securely cut off from the oven and the room in which the oven is located. All combustible material should be kept at least 12 inches from the back and sides of the oven. If the gas flame is underneath, a suitable foundation of terra cotta should be provided.

MACHINE SHOP.

The machine shop also comprises a large part of the plant. The hazards are those of ordinary metal work, combined with the extensive use of gas mufflers and brazing outfits. Mufflers should be set on metal tables or shelves. Where this is not possible there should be a stout metal shield on the table or shelf and a space of at least 6 inches provided between this shield and the burner of the muffler. A metal shield should then be placed midway between this burner and the table by inverting a metal pan or better yet a hollow terra cotta block. Many instances have come to my notice where these mufflers sitting on wood tables have entirely burned out all wood directly under them.

Brazing should be done on iron tables and where this is not possible there should be a protection of metal covered by a layer of terra cotta and brick.

PAINTS.

To my mind, this feature is perhaps the most dangerous in the process. There are various kinds of paints on the premises for decorative purposes or marking, but the most hazardous is the so-called "dope," which is used to coat the linen on the wings. Dope is a chemical prepared with a cellulose and acetone base, both of which liquids give off at ordinary temperature a

highly explosive vapor which in coming into contact with flame causes an explosion.

In itself, the dope is highly inflammable and when on fire is extremely hard to extinguish. In fact, the presence of much of this stuff would tend to seriously spread the fire and render fire fighting equipment useless. Three coats are applied to the surface of the linen. It contracts the linen, apparently making it very taut and slippery so as to decrease the wind resistance. It takes approximately 60 gallons for each plane so it can be seen that enormous quantities of this material must be kept on hand. A final application of varnish is applied on the wings to make them water tight.

THE "DOPE" HAZARD.

The hazard spot of the plant. Applying dope to the linen covering of the wings.

This dope or lacquer is received in barrel quantities, likewise the varnish, benzine, acetone and benzole. Paints or varnishes having 25 per cent. or more benzine, benzole or acetone are always considered the same as if they were entirely benzine, as far as the underwriter is concerned.

The amount of this material kept in the building should be reduced to the minimum and the supply should be kept in a

fire-proof building designed especially for the purpose and isolated from the rest of the buildings. Many times it will be found that barrels of this lacquer are stored outside and adjoining frame walls of buildings so as to be handy for the workmen. Other times tremendous quantities of this material will be found stored in frame enclosures adjoining or only a very short distance from the main building or even the boiler house.

All painting and varnishing should be done in a separate building or in separate sections cut off by fire walls with protected openings kept closed when not in use. At least there should be vapor tight partitions between the sections where the painting is done and other parts of the plant and there should be a ventilating system drawing out the air which is continually becoming charged with the highly explosive vapor. As this vapor is heavier than air, the suction fan should be located at a low point (near the floor) and care should be taken to have all bearings properly lubricated and protected so a spark at this point would not cause an explosion or a fire. Many times the painting section will be found located next to a part of the machine shop, with openings between a frame partition and where there are at 5 or 10 feet distance gas stoves and gas mufflers in use. Where this case exists it is only luck that prevents the explosive vapor from becoming ignited. Even where there are protected openings in division walls all open lights should be kept as far from these openings as possible.

Dipping of metal parts into lacquer or japan and spraying metal parts by brush should also be in this same section or may be in another section if separated from the open flame hazards. Sometimes gas heated dry ovens will be found in the same room with dipping and spraying process. This should not be permittted.

GASOLINE.

A word might be said here about gasoline which is really no more hazardous than the dope. The quality of gasoline used for aeroplanes has a specific gravity of from 72-80 while the specific gravity of that used in the automobile industry is about 60-64 and is to be lowered to 50-60. This means that the aeroplane gasoline is a better quality and more explosive and therefore subject to greater danger. It is about the same as the specific gravity and quality of the commercial benzine. It is kept on the premises for testing motors.

POWER PLANT.

Boiler houses should be detached and kept as far as possible from the painting department. There should be no woodwork *within 4* feet of boiler and a metal thimble must be provided *for the stack (if metal)* where piercing the roof. This thimble

should be 36 inches larger in diameter than the stack. Where electric current is generated in the building the wiring and changes should be approved by underwriter boards having jurisdiction. Generators should not be in sections where there may be explosive vapors. Waterproof tarpaulins should be on hand to cover motors in case of emergency because electric motors may suffer severe damage from a slight amount of water.

AUTOMOBILES AND MOTORCYCLES.

Office force and workmen ride to and from their work in automobiles or motorcycles. These should not be run inside or kept in the buildings owing to leaking of gasoline, etc. Many times when machines are started a backfire occurs in the carburetter or an after-explosion in the muffler which emit sparks and have caused many disastrous fires. This hazard is intensified where there are quantities of lacquer, acetone, etc.

SMOKING.

This should be absolutely forbidden for the hot ashes falling on a finished aeroplane wing would be apt to cause a flame that would get beyond control. "No Smoking" signs with letters at least 4 inches high should be displayed freely and in conspicuous places. Workmen caught smoking should be discharged for the hazard to fellow-workers is serious.

HOUSEKEEPING.

The pressure under which these plants are working is apt to cause those in charge to neglect the proper care. Lack of metal rubbish cans, or oily wood floors under machines and empty fire pails may often be found. Sometimes papers and rubbish will be found in bottom of shafts and lack of proper receptacles for paint or oily rags. Metal drip pans should be placed under all oily machines. Oily iron filings kept in wood boxes should be replaced in metal cans. Kerosene oil lights (kept especially in the boiler house) should not be carried in the buildings when lighted; in fact, they should be removed from the premises entirely.

Crowded condition and lack of proper aisle space will often be found especially in machine shop sections where employees have to elbow their way from one part of the room to the other. At least a 3-foot aisle space should be left and overcrowding should be discouraged especially for its danger to life through accident.

EXPOSURE.

Windows and other openings where facing and near other hazardous properties should be protected by wire glass windows in hollow metal frames or standard tin clad fire shutters. If parts of plant are in separate buildings those of the least hazard-

ous especially should be similarly protected from those near by. Buildings within 100 feet of each other are considered exposed and should be guarded from this hazard.

The inspector should note whether any aeroplanes are kept in open yards and if railroad tracks are near where flying sparks from locomotives might cause a fire.

FIRE PROTECTION.

Armed guards are the best protection in an aeroplane plant. The very nature of the product would make an excellent excuse for some enemy alien to do what he thinks may be his duty for his country by starting an incendiary fire. The more red tape and difficulty an inspector encounters to get within the plant, the better can be rated this protection. Of course this does not mean that there need be no internal or external fire protection. Rather the contrary, there should be an adequate supply of fire pails (one to each 500 square feet), soda and acid chemical extinguishers, and the one-quart type containing carbon tetra chloride. This latter type is of particular value in fighting paint and oil fires because of the gas blanket effect it has when squirted on the flames. The gas blanket excludes the oxygen and causes the flames to extinguish, because fire cannot burn without oxygen. A watchman with clock should make hourly rounds at nights and on idle days.

A standpipe system with a constant water supply should extend throughout building and outlets with 50 feet of approved linen hose should be provided for each 5,000 square feet. A standard fire pump of at least 750 gallons per minute capacity would be a valuable asset. If without side hydrants and provided with plenty of hose in a detached metal hose house and if pump with power supply is detached from main plant this would be a formidable protection. Inspector should find out if water mains are ample to keep pump supplied continually when running at full speed. A large reservoir for suction would be desirable.

SPRINKLERS.

A sprinkler equipment is not an absolute stranger to these plants. If a high grade equipment with adequate supplies it is hardly possible for a fire to cause much damage. This protection increases the desirability of the risk many fold and reduces the seriousness of most all hazards with the possible exception of the storing and handling of "dope" paints, benzole, acetone, and benzine. Care should be exercised to note unsprinklered portions (sheds, dry boxes, etc.).

CITY PROTECTION.

Where factories are located on outskirts the inspector should *note* how many hydrants there are within 500 feet of the plant. *In outlying territories* I have seen three hydrants at one end

of a 1,000 foot building with no others on the property. This you can see places three quarters of the property out of protection while the other end may have more protection than it needs. In outskirts inquiry should be made as to the size of the water mains for it can be seen that ten hydrants would be of no value if the mains are only 3 inches in diameter.

Inquiry should be made regarding the pumping station. In one case I found a certain town had one pump with which they were having difficulty and this pump was out of order a great deal, at times seriously affecting the quantity and pressure of the water in the mains. A shaft on this particular pump was

TURNBUCKLE MAKING.

Hundreds of girls are employed making and fitting turnbuckles.

slightly oval and melted out a babbitt bearing. There was no reserve pump or spare shaft on the premises and owing to the length of time necessary to obtain a new shaft there was no alternative but to rebabbitt the bearing with the inevitable recurrence of the trouble.

Inspectors should note changes or additions to fire departments, volunteer or paid, note how the apparatus is hauled or drawn, also distance from plant, surface of roads and whether hilly, level or narrow.

RATES.

In view of the numerous hazards presented in this manufacture and the susceptibility which will be explained later, rates as a rule seem to be low.

USE AND OCCUPANCY.

Things change rapidly in flying. Tools for making certain parts which may be discontinued might become obsolete. The ending of the war may cause a sudden lull in the manufacturing. Metal and tools are scarce and in case of fire it might take some time to obtain new tools and supplies. Spruce wood is difficult to get and a company might find itself with many high salaried men (due to the labor shortage) on their hands without the materials to work with. Delays in shipments during these times are common and rehabilitation might be indefinite.

SUMMARY.

A slight fire would cause severe damage, probably more by condemnation than by actual destruction. Whole machines may be condemned because temper may be taken out of various metal parts, weakening joints, frame or linen covering and if used might be the cause of death to our brave aviators.

The writer was asked some time ago what was his definition of an aeroplane factory which would include the hazards as a whole.

The answer which probably briefly sums up the matter in a nutshell was:

AEROPLANE MANUFACTURING consists of power woodworking, gluing, metal working, wiring wood parts together, covering planes and rudders with linen, varnishing wood parts and propellers, coating fabrics with lacquer having a cellulose base. Main hazards are storage and use of large quantities of lacquer, woodworking, testing gasoline motors, glue melting. Usually located in old buildings, large open areas subjecting whole plant to one fire, and contents of which very susceptible. A small amount of heat will render a machine valueless on account of removing temper of guy wires, braces, and weakening framework and structure.

FIRE PREVENTION A NATIONAL DEFENSE.

Urgent Need of Curbing Fire Waste, and Methods Suggested for That Purpose.

H. C. Brearley, National Board of Fire Underwriters.

At this most dramatic moment of the whole world's history, when ancient tyrannies are crumbling before our eyes and when, we believe, a new and better age is about to be born, this meeting has a very peculiar significance. For the past year and a half our problems have been largely those of destruction, but soon, we trust, we shall become absorbed in the still vaster problems of construction.

We like to believe that the United States is to play a leading rôle in this work. In that case New York, as the nation's largest city, must be the center of leadership, and we are New Yorkers, meeting with members of the administration in the historic seat of government upon a subject that has a very fundamental bearing upon the future.

I trust that we have not come to this Fire Prevention Day meeting in an entertainment spirit; if so, may we not lay it aside and think of ourselves as personal participants in a gathering that may have a far-reaching effect?

Note this: Leadership is not to be determined by claim or by courtesy; it will go to that people which is most fit to exercise it, and there are important respects in which we Americans have by no means established our fitness. We have some things to teach, yes; but let us in all humility and earnestness grapple with the things which we have to learn.

If, then, we are to enter an age of colossal construction is it wise longer to cherish our American vice of senseless destruction? And of all forms of senseless destruction probably the most senseless—the most totally inexcusable is that of preventable fire.

New York City has an excellent fire department. I suppose that in many respects it is the best in the world. This department is properly a source of civic pride—quite as properly, it should also be a source of civic shame. The Hawaiian natives are good swimmers, principally because they have so much water, and one of the reasons for New York's excellent fire department is that we New Yorkers cause so many fires. We walk lightheartedly into trouble, and trust that our brave and skillful force will get us out.

Consider for a moment this vast hive of 6,000,000 very busy and very careless people. Without such protection we might burn ourselves out every few months, for fire is the natural by-product of American habits. This is bad enough where one family lives by itself, but when 6,000,000 people are brought together within comparatively narrow confines, you multiply hazard enormously because the carelessness of any individual imperils an indefinite number of his neighbors.

The New York fire problem also includes nearly every known form of manufacturing and storage hazard. According to recent figures, New York has more manufactories than the next four American cities combined, and includes such especial hazards as chemical production, clothing production and many others. High buildings, narrow, crowded streets and the inflammable character of many of the materials and goods in manufacture and storage—all of these involve a particular danger to life as well as property. In spite of the high efficiency of the fire department, fatal fires are a very frequent occurrence.

ELEMENTS OF DANGER.

The congested character of the population is in itself an element of danger. The differing habits of different classes is another; for example, the use of candles upon certain religious holidays is a well-recognized hazard and a cause of countless fires. Holidays and special observances often leave a trail of casualties behind them. Fourth of July fires have now been nearly eliminated, thanks to laws and education, but the deadly Christmas tree candles and inflammable decorations still take their regular toll. Only last December a nation-wide hazard was suddenly and unthinkably introduced by the Red Cross in its recommendation as to lighted candles in windows on Christmas Eve. Here is another dangerous suggestion printed by a usually level-headed New York daily so recently as last Wednesday under the commendable heading, "Don't Use Food for Decoration." It says:

"Of course our children mustn't be cheated out of this Hallowe'en fun just because it's war time. But surely nobody will waste pumpkins this year, especially when pumpkin substitutes are so easily made from yellow crepe over pasteboard forms. The boxes daddy's hats come in are simply fine for this purpose."

A prominent insurance man sent me this clipping with the pessimistic comment: "One almost despairs at times of getting the smaller element of the idea of fire prevention into the average mind. What can better invite our amiable little savages to become arson breeders on the shortest possible notice."

Well, my friends, this is the sort of thing that we are up *against. It is* highly characteristic. It is on every hand, every

minute. Don't you really wonder that we are not all burned up when you stop to think it over? Don't you begin to appreciate what we owe to the quick-acting and clear-thinking men in the blue uniforms that we have actually kept the city in which we live and work?

And let me digress for a moment to give an instance, unnoted so far as I know, of the quickness and intelligence that are characteristic of the New York force. A year or so ago an explosion occurred in a section of the Seventh Avenue subway then in construction between 24th and 26th streets. Fire broke out and began to eat its way toward four or five men who had been pinned down by heavy timbers. The explosion also destroyed the water mains so that the hydrants were empty.

The engineer of the first fire company to arrive—No. 19 it was—found that the hydrants were useless and that the men were in danger of being burned to death. He instantly realized, however, that there was a 30,000-gallon tank of water on the roof of an 18-story building close at hand. Without a moment's hesitation he dragged a length of fire hose into the hallway, coupled it to the standpipe, turned on the water and put out the fire.

No one paid especial attention to this action because a New York fireman is especially trained for emergencies in the fire school conducted by the department, and there were probably hundreds, if not thousands of the others who would have done equally well under the same conditions.

FIRES TO REMEMBER.

However, excellence of protection should not make us reckless of danger, for the smallest fire, at the start, will spread if it gets the chance, and, always looming up in the background, is the terrible menace of possible conflagration. Can you, who remember San Francisco and Baltimore and Salem, imagine what a general conflagration would mean in this huge city? I do not wish to pose as an alarmist, but it is well that people should realize the true nature of the situation. I remember several years ago coming down in a subway train with an official of the Bronx Zoo. This man carried with him a suitcase containing some live snakes for use in connection with a lecture that was to be given that evening. The creatures were all of harmless varieties, but we laughed to think of the consternation that would have resulted among the other passengers could they have known what that innocent-looking suitcase really contained.

In a much more serious way, the residents of this city are frequently brushing elbows with the unsuspected. They are surrounded by perils that only a combination of skill, vigilance and general good luck have kept from being terribly disastrous, and there have been at least two well-recognized occasions when a

colossal conflagration was an imminent probability. One of these was at the time of the great water famine in November, 1891. Before the rains finally came, the reservoirs had been lowered until there was only forty-eight hours' supply for the city in sight, until the gates on the four-foot mains leading from the Central Park reservoirs had been shut down to within an inch and a half of the bottom. If at this particular moment the city had experienced a combination of an unmanageable blaze and a high wind there might have resulted a disaster five or six times greater than that of San Francisco—one that would almost certainly have cost thousands of lives and hundreds of millions of dollars in property destruction

MAYOR'S PROCLAMATION.

To-day we are enjoying a greatly increased water supply and we have also the advantage of the high pressure system of salt water mains. With abundance of water and an admirable department it might seem, therefore, that we could be indifferent to conflagration hazard, and yet the second of the two most critical moments occurred only last January. Most of you will remember that the city was placarded with copies of a proclamation, signed by Mayor Hylan, as follows:

"To all citizens of New York City: This city is menaced by the imminent possibility of a general conflagration. Recent severe cold weather, combined with the shortage of coal, has produced a condition of gravest menace. Those buildings which, because of sprinkler protection are usually counted upon to serve as fire barriers, are now virtually without such protection. The chief of the fire department has sounded the warning that 'if to these conditions a moderately heavy fall of snow is added, making it difficult to move heavy fire fighting apparatus, a disastrous conflagration would be not only possible, but highly probable.'

"The unprecedented concentration of population and values in New York City might easily turn such a conflagration into a disaster of the first magnitude. As mayor of the city of New York, I hereby call upon all citizens to co-operate for the public safety by the following means:

"1. To have a sufficient number of water barrels and fire buckets or other form of fire extinguishers ready for immediate use in all buildings.

"2. To provide adequate emergency watchmen service in all buildings until the present crisis is past.

"3. To ascertain the location of the nearest fire alarm boxes, and to study the directions for sending in alarms.

"4. To observe especial care with matches, lights, heaters and all other forms of fire hazard.

"5. To have all waste paper, packing material, and other com-

bustible rubbish put in metal containers and removed from buildings daily, and keep basements and cellars perfectly clean."

Now, the significant thing about this proclamation is that it was addressed to "all citizens of New York." It was not addressed to the police department, for the police department, as an effective auxiliary, is vigilant and dependable. It was addressed to all citizens of New York, with the emphasis upon the all. The reason for this appears from the study of some most illuminating figures that were furnished by the New York fire patrol. These figures cover only the boroughs of Manhattan, Bronx and Brooklyn, and they show that out of 22,083 fires reported in the year 1917, 12,385 occurred in places of residence, namely: 9,038 in apartments and flats, 2,653 in private dwellings and 694 in rooming houses.

This total of 12,385 is, as you will see, 2,687 greater than that of all business establishments and all other forms of occupancy combined, and when you compare it with other individual items the difference is astonishing. For example, the next two in point of size are those of restaurants, with only 270 fires, and retail groceries with only 189 fires for the year, respectively; other occupancies run from this point down to one or even zero.

Let us revert again to the total. If we take the 22,085 fires in this single year in the three boroughs and add an estimated 2,000 more to represent Richmond and Queens upon the basis of their proportionate population, we have a total of approximately 24,000 fires in Greater New York within a year. Twenty-four thousand fires in a year means 2,000 each month, sixty-seven each day, or one for every twenty-two minutes on an average in this city alone. In other words, in all probability fires have broken out within the city limits since we entered this room and other fires will break out before we leave. This is a somewhat startling thought, is it not? Fires that have already occurred we tend to dismiss from our minds; they cannot be helped, but what about the fires that have not yet occurred? They can be heleped. Who is going to cause these fires? We are, we who are here in this room and our fellow New Yorkers. Do we expect to cause them? No; nobody except a criminal has expectations of that kind, but we are going to cause them just the same at the rate of one for each twenty-two minutes each day throughout the year, unless we make a profound change in our habits. Remember this: Every careless New Yorker is a potential incendiary in effect, whether he be so in purpose or not.

STARTLING FACTS.

Let me read a statement of four facts from the most recent report of the New York fire department that has yet been published—that of the year 1916. These are:

1. Three-fourths of the fires in buildings in 1916 occurred in

people's homes; that is, in tenements, dwellings, furnished room and boarding houses. Factory buildings had only 11 per cent.; public schools is less than two-tenths of 1 per cent., and theatres less than one-tenth of 1 per cent.

2. The largest single cause of fires last year was the careless use of cigars, cigarettes and smoking pipes. Over one-fourth of all the fires in New York in 1916 resulted from this and two other forms of easily avoidable carelessness; the careless handling of matches and children playing wtih matches and fire.

3. Three-fourths of the total loss of life in fires occurred in fires in people's homes—tenements, dwellings and furnished rooms and boarding houses. Less than 10 per cent. occurred in factory fires.

4. The largest single cause of these deaths was the ignition of gasoline, benzine and alcohol vapors, practically always due to a careless or ignorant handling in the home. Among the other causes of fatal fires were children playing with matches, careless handling of matches, upsetting kerosene oil lamps, pouring kerosene oil on fire stoves and similar forms of avoidable carelessness.

These four facts taken together mean that in people's homes —in tenements, in private dwellings and in boarding houses— where the fire department has least jurisdiction and least authority to insist on adequate methods of fire prevention, three-fourths of our fires and three-fourths of the consequent loss of life occur.

Do you notice the way in which that word "carelessness" is reported again and again throughout these statements? Perhaps you may have thought that the solution of the fire problem did not go farther than the matter of fire equipment, a fire fighting force, alarms, water supply, building inspection and such technical and professional subjects. My friends, I want to tell you that all of these put together are merely incidental to the real solution of the problem. The fundamental cause of American fire losses is found in American carelessness. This point can never be too much insisted upon. The problem is less technical than psychological. This is so obvious with a little thought that it does not even call for proof. Were instances required I could deluge you with them for forty days and forty nights, but here are two that I cannot forbear to quote. One is contained in the following clipping from the New York *Herald:*

"Extravagance as an item for connubial debate has brought household wrangles to a plane not reached before the high cost of living became the one topic 'cussed' and discussed in every home, hovel or apartment house. So criminal has extravagance *become* that even the law recognizes it as a mitigating circum*stance in wife* beating.

"So yesterday in Domestic Relations Court, when an unrepentent husband was telling why he left home because his wife insisted upon Waldorf menus on an automat income, the wife raised her hand appealingly,

"'May I say something, your honor?" she inquired. 'My husband's been extravagant, too.'

"'How is that, madam?'

"'Why he bought a fire extinguisher more than a year ago—paid I don't know how much for it—and we've never used it once.'"

By way of contrast, note this story which was published in a St. Louis paper under the heading of "The Spirit of American Soldiers":

"The troops were going through a village in France and a small fire broke out. The fire apparatus had not been used since 1873, but the hose was all right, and when it had been attached to the fire apparatus performed its function well for the Americans. It was the first fire in the village in forty-five years."

Do you get the complacent spirit of the heading, "The Spirit of American Soldiers?" It should have been headed, "The Spirit of French Villages," for, by all odds, the most significant statement was, "It was the first fire in the village in forty-five years."

PROBLEM TO BE FACED.

Now, my friends, we are fondly hoping that Europe will emerge from the great war with its eyes open as to the evils of autocracy, ambitions of conquest and some other cherished institutions; but let us not be too complacent; let us hope and pray that we, too, may learn to appreciate at their true valuation, the ghastly extravagance of our own cherished institution—that of carelessness in the matter of fire hazard.

A writer upon certain of the Asiatic tribes says: "These people look upon fire as an act of God and, therefore, think it is useless to attempt to extinguish that which he has kindled." We have progressed somewhat from this viewpoint. We no longer hesitate to fight fire when it has been started, and rather recently we have undertaken certain steps in engineering and inspection to fight fires before they start; but let us be honest with ourselves. Let us face this problem down in our hearts. Let us say: "My building is not the greatest of my fire hazards, but my habits are. I am a typical careless American of the old careless era, but I and my fellows are emerging into a new era when carelessness must be left behind or else I will find myself out of step with the march of progress. I must work a fundamental reformation not only in my habits but in my character. I must become an efficiently, patriotically, careful American."

This is not easy, do you say? No, I grant you that. Changing from familiar, fixed habits never is easy, but possibly some of you recall a little wall placard that was produced several years ago, containing six lines one below the other in type which was very small in the first line and successively larger in each that followed, until the sixth line stood out bold and black in letters an inch high. These were the lines; let us take them to heart; they are a lesson in character building:

The first begins in the smallest type, "I can't." The next a little larger in size, "I wish I could." The third still larger, "I wonder if I can?" The fourth, "I think I can!" The fifth, "I can!" And the last of all, the sixth, fairly shouted forth in triumph, "I WILL!"

Now, just a word of practical application to immediate conditions. The winter is nearly upon us; it may not be a winter of such severity as that of last winter, but, again, it may. Last year, as already stated, the citizens were in a peril that they scarcely realized. With the force depleted by the draft, with the number of fires greatly increased by overworked heating systems, with fire fighting made more difficult by the severe cold, with 75 per cent. of the sprinkler equipment at one time put out of service and with the abnormal hazard of wartime manufacture and storage, it is small wonder that our department was nearly exhausted by its tremendous efforts. The men worked incessantly—sometimes for as much as three days and three nights continuously without rest. That is the kind of service that they are giving us. In the spring, therefore, the department proceeded to organize a citizens' auxiliary of 4,000 men, serving patriotically without pay. These men have been uniformed and equipped at the private expense of public spirited citizens and are already helping to fill out the companies, particularly at this time of epidemic.

But even this is not enough. We must have a New York fire department auxiliary 6,000,000 strong if the city is to be made truly safe. In other words, every one within sound of my voice and every one of our compatriots must take this question personally to heart and must determine, under no circumstances, to permit a fire to arise through his carelessness or upon his premises. This is essentially a question of care, of cleanliness and reasonable precaution. In this day we are seeing our civic duties in a new and larger light. May we not all without delay enlist in this great work?

AMERICAN REINSURANCE

Should Become Dominant Factor—Specific Study of Foreign Company Results.

By Henry M. Schnarr, Secretary, Wemple & Co., Inc., New York City.

The word "Reinsurance" is indeterminate. Possibly, it may be defined as the vital force of the insurance business. At any rate, the success of insurance companies operating in the United States is not only strictly proportionate to their capital and surplus, but as well, to their reinsurance facilities. And insurance, unlimited in scope, is big business. It nicely gauges our productiveness, applying alike to field, mill or warehouse, or the finished product on its way by rail or water to the final consumer's hands. Insurance against loss attends each movement and the consumer, covering his possessions and dwelling in the last step, completes the cycle.

The European underwriters, revealing their capacity, ingenuity and resourcefulness in reinsurance specializations, through their experiments in the early years of the twentieth century, became the pattern for the greater foreign reinsurance movement of to-day. Their knowledge of facts and what they taught as sources for advantageous returns on investments in their undertakings in offering facilities to insurance companies in the United States justified the adventure, and for many years past there has been no hesitancy or uncertainty on the part of European financiers in organizing companies or a consortium of companies to open their branches, under American management in the United States.

The incomparable significance of the American insurance field led many European organizations to seek the ever-increasing business of American companies. It was a rich field—a field beyond the non-profitable or constructive-year periods required to place the insurance institutions on a money making basis to their investors. Insurance companies, without sufficient financial strength to carry them over their constructive periods, have lost money, but the records of reinsurance companies show that since the opening of the first American branch in 1899, no failures have occurred, though the Federal and State regulations are identical for both insurance and reinsurance companies.

DO NOT COMPETE.

Reinsurance companies are in no sense in competition with

insurance companies. They are identical with the interests of the direct writing insurance companies, so the first thing we observe as a difference between insurance companies and reinsurance companies is that insurance companies require building up to a profit producing period, usually from three to ten years, while the reinsurance companies carry on the built-up business of insurance companies that have reached the profitable stage.

There has been much of value written pertaining to particular parts of insurance business, but no one seems to have tried to deal with reinsurance as an important factor to insurance. That reinsurance plays a very important part, both as to its necessity to the insurance companies and to their expansion, is attested by the fact that in 1917 the fire and marine companies paid for reinsurance facilities the sum of $252,776,078 in premiums.

Complicated calculations covering years on hazards are analyzed, averages are computed, ratio per loss or expense, etc., is figured to the lowest decimal, until year by year, data is to hand which leads to a basis under the law of average, that any kind of risk of whatever nature, is rated. It has taken many years to develop these accurate statistical records, and therein lies the success of the insurance companies. As all insurance companies operate under State and Federal laws, these laws regulate the amount of business a company may write, the object of the law being to protect the policyholders against insufficient funds should at any time catastrophe come to the organization. A tremendous expansion and a greater opportunity to write big business was permitted to insurance companies solely by feeding their excess writings to foreign reinsurance companies.

The German has been pre-eminent in this adventure, grasping its possibilities even as early as 1899. He had by 1915 organized an elaborate business system which practically monopolized the entire reinsurance field. These reinsurance companies considered not the science of insurance, but the art of turning profits out of business created, developed and increased beyond the insurance companies' resources. Therefore, American insurance companies, through contract or treaty arrangement, placed their overflow business with reinsurance companies; hence, as the American insurance institution has been profitable, the reinsurance companies have profited in the same ratio, and reinsurance co-operation has contributed vastly to the expansion of business in all insurance lines.

PHENOMENAL GROWTH.

Our American insurance companies are puzzled by the phenomenal growth and extraordinary progress made by the foreign reinsurance institutions; still their knowledge of them is

limited. Content to know only that they are as legally authorized as themselves, they there place the major portion of their reinsurance business. In like manner these foreign companies, devoted wholly to reinsurance, have only a very limited knowledge of what the other fellow is doing; of the tremendous efforts made by our American insurance companies along their differing lines to develop their field forces, to perfect their internal organizations, or in the proper compilation of statistics, as a basis for classification. Thus, each knows the other only in part, yet are they vitally inter-dependent.

Receiving their business on the same relative basis as the American companies, the foreign reinsurance companies benefit directly in proportion to their contracts with these highly organized American institutions. All reinsurance companies, though primarily writing insurance as explained, are, besides, distinctively a banking business. Income is received from underwriting, but being owners of invested assets investment income is also received. And the second observation shows us that the non-productive years of up-building for reinsurance companies are avoided.

When war was declared on Germany public opinion was strongly opposed to giving any insurance whatsoever to the German companies; hence policies in these companies were heavily cancelled. Nevertheless, in 1917 the German reinsurance companies were covering risks aggregating $1,501,014,146 secured through reinsurance from American companies, and these foreign reinsurance companies to-day are being conducted by the United States Government. Only one of these enemy alien reinsurance companies has been sold, and that in December, 1918, the reason for such non-liquidation policy appearing in the following order as signed by the Hon. Frank L. Polk, Acting Secretary of State, on December 4, 1918: "That the said stock, etc., etc., * * *, and it is the expressed opinion of State officials having supervision over insurance companies, in which I concur that it will be to the best interests of the people of the United States, to continue the said reinsurance company as a going concern, rather than allow its liquidation and dissolution at the present time."

CLOSE STUDY NECESSARY.

The examination and appraisement of reinsurance companies specializing in this form of insurance only is full of instruction. At every turn it reveals specific profit in proportion to the successes of the feeding companies. But it is easier to state tangible facts than to communicate impressions. The American insurance companies, having secured a large volume of business, retain of this a specific percentage and reinsure the balance. This balance is transferred at the same rate as written. The

risk to which such business as this is necessarily open is safeguarded by close analysis of experience in the past—always a part of the complex machinery of all great insurance companies while every known precaution is taken to diminish the chance of such risks arising.

The losses of American insurance companies are well known, showing by ratio comparisons year by year in the State insurance reports. Should a reinsurance company be under contract with but one American company, the loss ratios to premiums might well be nearly identical. Yet, these reinsurance companies abroad contract, not with one, but with many, and it is of record that as high as thirty of our American companies are giving their business to a single foreign reinsurance company.

In as much as we possess no companies specializing in reinsurance, this field, as stated earlier in this memorandum, is so fully developed abroad that we are at present wholly dependent upon Europe for our needs. In this connection let us note that in 1917 out of a European total of one hundred and forty-three reinsurance organizations, twenty-three were specializing here in reinsurance, manifestly indicating not only our weakness in not ourselves grasping this business opportunity, but as well, its vast certainties of profit when properly pursued. Analysis of these reinsurance companies' operations, aside from its convincing evidence of profit for them in a field where we should also be, shows that as all American companies without exception, participate in giving some or all of their business to at least one, and in some cases, to as high as six of these foreign reinsurance institutions, that therefore reinsurance has its foundation solidly laid in the confidence and the support of all insurance companies in the United States.

Yet, to our underwriters of financial undertakings, even to our bankers themselves, this subject of reinsurance is almost unknown. Some knowledge they possess, of course, but at best it is more or less superficial; not grasping its true significance, its vast possibilities for profit, they have failed in seeing how readily it may be commercialized. And its development has only begun. Although monopolized by Europe, to-day it is a potentiality to be reckoned with, and it is the writer's hope that American reinsurance may soon be what it may easily become, namely, the dominant factor in the reinsurance field of all the world. Nor is this a chimera or a dream: all it necessitates is confidence in the undertaking, constructive thought on a basis of reinsurance business experience, but above all, strong leadership. With these assured success is certain.

USE AND OCCUPANCY INSURANCE.

What It Is—How It Covers—Methods of Rating—Features of Underwriting.

Extracts from an Address by General Agent F. C. White, New York Underwriters Agency, Before the Wisconsin Association of Insurance Agents.

I am going to start by saying that use and occupancy insurance is nothing more nor less than insurance against loss of net profits. I have heard it argued that full use and occupancy insurance never was intended to include profits, and I want to make it very clear at this time that such belief could only result from a total misunderstanding of the purpose of use and occupancy insurance. Under this form of insurance we undertake to reimburse the insured for the loss he may sustain because he is prevented from using his plant by reason of the disaster named in the policy—fire or tornado or explosion or any other cause, as the policy may be written. Now, what purpose has any person in operating a business? One only, to make a profit; so the valuable thing he loses when his business is interrupted is the ability to make a profit. Use and occupancy insurance bridges the gap and pays the profit until the plant can be restored to operating condition. Limited use and occupancy policies occasionally are issued which do not cover profits. I shall refer more particularly to them later on, but a full cover is most certainly insurance against loss of profits.

THREE VARIETIES.

There are three kinds of profit contracts in common use, and it may be well for us first to consider them briefly in order that we may have thoroughly in mind the points of difference.

First—Use and Occupancy—a contract which provides per diem indemnity for loss of profits, or in other words, makes it possible for an insured to avoid during a period of business interruption the loss of such profits as would have been earned during that period had no interruption occurred.

Second—The profit policy which provides that an insured shall be paid for loss of profits which he may sustain through inability to carry out the terms of sales contracts. This form of insurance contains wonderful possibilities for the insured, but it is difficult to see how any company could be persuaded to accept such all-inclusive liability without having opportunity to even

estimate in advance whether a property damage of, say, 10 per cent. would entail a loss under the profit policy of 10 per cent., or the face of the policy.

Third—The profit policy under which liability is assumed for a certain percentage of the sound value of goods destroyed or damaged. This form of contract was devised to reimburse the insured for the profit he would have earned on goods destroyed or damaged had he been permitted to market them in the usual way. Under a non-valued contract this insurance falls short of giving the same protection that would be afforded by either of the other forms referred to. Under a valued contract it might readily become an incentive for a dishonest insured to sell his goods to the insurance companies.

I have heard the statement made that the limit of a use and occupancy policy could be defined in the briefest way by saying that such policy is intended to cover all damage that an insured might sustain beyond the cover of direct insurance. I cannot subscribe to that definition. For example, it is not within the scope or purpose of a use and occupancy contract to pay the insured for all loss sustained through the severance of business connections by reason of a temporary interruption of operations. The full obligation under a use and occupancy policy is to pay for each day's loss from date of fire until the property named in the policy has been restored. However, in my judgment, this form of indemnity affords as full cover as could properly be expected, and while not as comprehensive as the incendiary profit policy covering future contracts, might be made, it meets the needs of the insured fully in the large majority of cases, as is well evidenced by the growth of this branch of the business since it has become better understood by the insuring public. In England, I believe, the first form of profit insurance written was similar to the one I have referred to, which pays a certain percentage in addition to the sound value of goods destroyed. It was there known as "Excess Fire Insurance." In time the inadequacy of this insurance was recognized, and another form of contract, called "Consequential Loss Insurance," was devised to take its place. Under the latter form companies obligated themselves to pay for loss of profits sustained during loss payment "periods" named in the policy, such periods running from three months up to three years, the usual period being three months. Their policies contain no per diem feature. Their process of loss settlement is to have an adjuster go over the insured's books at thirty days intervals after a loss, and by them determine how the output compares with that of the corresponding period in the previous year. Any diminution of output developed by such comparison is used as the basis for adjustment, and it is customary to pay the insured each month until

the business has become normal, or until the end of the stated loss payment period. There is much that recommends itself in this dignified and equitable method, but I shall leave it to you to estimate how popular it would be if introduced in our country, where the insured has become accustomed to receiving a draft in full settlement almost before the smoke has cleared away.

To the best of my knowledge, use and occupancy insurance is purely an American institution. The first contracts issued by stock companies were written in New England about thirty-five years ago. Occasionally since that time the business has been galvanized into activity for a short time through some unusual condition, but for the most part the class has been looked upon with suspicion by the companies, with the result that there was little encouragement for agents to make themselves conversant with its details. A few companies, however, have for several years past accepted use and occupancy liability freely, with certain reasonable restrictions, and assisted their agents in becoming competent use and occupancy underwriters. Those companies by degrees accumulated some volume of premiums from the class, and it was when this fact was borne in on their competitors that use and occupancy became more a subject of general interest. The war finally gave the business what I fear was an unhealthy impetus, of which I shall speak later on, and to-day use and occupancy is a recognized factor in our business, although by no means the most important one, and a subject for profitable study by each and every one of us.

CLEARER TITLE NEEDED.

Since the early writing of this form of indemnity it has been known as use and occupancy insurance. Why a title so lacking in descriptive qualities should have been selected I do not know. With a full knowledge of what use and occupancy insurance is, it is not difficult to imagine that what the author of the title meant to express was, insurance against loss sustained through inability to use and occupy certain premises to be described in forms bearing the title. Whether that was his intent I cannot say with certainty for history is silent on that head. The only point of real importance to us in connection with the matter is that the title use and occupancy has no legal status, for thus far the courts have failed to define its meaning. This fact makes it absolutely necessary that each use and occupancy form shall contain a full description of what the issuer means by the term use and occupancy. Of course it would be quite in order for any one to devise another title for the business, and it would not be hard to work out one that would be much more appropriate than use and occupancy. However, we are creatures of habit, and I presume that for years to come we shall see forms headed by that title.

If you will allow me to speak here of a matter that is indirectly a personal one, I would like to tell you of an amusing phase of this title question. About ten or eleven years ago we decided in our office that a clearly descriptive title for this form of indemnity would be helpful to agents and insured, and also would give a little individuality to our forms; so we got together, and from a long list of titles suggested by men in our office we selected "Business Interruption Indemnity" as being the most clearly descriptive. We printed it in our forms and we alone used it for several years thereafter. Then one by one other companies adopted the title, which was quite in order, since it was not copyrighted. Quite recently there has been considerable argument, which has caused us some quiet enjoyment as to who really devised the title. It has been attributed to several gentlemen. Some have repudiated it, others are still resting under the "soft impeachment." To cap the climax, I was told a short time ago by a gentleman in another office that his company devised both the title and form which they were using, when, as a matter of fact, the title was "Business Interruption Indemnity," and the form was a verbatim copy of our own.

THE COVERAGE.

With the thought in mind that we must thoroughly understand use and occupancy contracts before we can succeed in developing the business. I have given considerable space to that subject. In considering the question of contracts of this character we should always remember that in the United States and Canada usage has decreed that use and occupancy insurance invariably shall be written on a per diem basis. It is necessary for us to remember this to avoid confusing use and occupancy with other forms of profit insurance.

Generally speaking, no contract of use and occupancy can safely go farther than to agree in plain terms to indemnify for actual loss sustained. Indeed, it should fall somewhat short of doing that, for it is not too much to say that the insured should be at least a partner with the insurance companies in any misfortune (within the limits of the policy) which may befall his property. One can readily understand that there would be insufficient incentive for protecting against hazards to property if the future held no penalty for failure to do so.

It is true that what we have become accustomed to hear described as "the exigencies of the business" have resulted in the writing of valued use and occupancy policies on sprinklered risks. It would be even more difficult, however, to defend the issuing of valued use and occupancy policies than valued direct policies. It might be measurably safe to over-insure a prosperous business concern under a direct policy because, with a profitable future definitely in prospect, the loss of business connections which

would result from a serious shutdown ordinarily would not be compensated for by such over-insurance. Add to the direct insurance, however, valued use and occupancy indemnity in amount sufficient to give to the holder a larger income while idle than while operating, and immediately we are confronted with at least a passive moral hazard; a sort of "don't care a hang" feeling, which goes naturally with the certainty that the future is more than safely provided for.

The question is frequently asked, "What should be covered under a use and occupancy policy?" My answer would be, that under a use and occupancy policy nothing should be undertaken beyond paying the insured for each day that his business may be entirely interrupted by the disaster named in his policy, a sum sufficient to allow him to retain unimpaired the net profits that would have been earned had no disaster occurred. Reduced to the last analysis, that is exactly what a proper form and an adequate amount of insurance would provide, for use and occupancy insurance, as we know, is nothing more nor less than per diem profit insurance. In order that the insured may collect his full unimpaired net profits, it is necessary, of course, that the form shall include all items of expense which must continue during the time his business remains unproductive. This is obviously so, because during such time the use and occupancy insurance would be the only source of income directly applicable to the business insured.

The rules which regulate our underwriting permit ample latitude for expressing the liability. A wording commonly used is as follows:

It is understood and agreed that the term "Use and Occupancy," as herein used, shall be construed to mean net profits; general maintenance to the extent of taxes, heating and lighting; legal liability of assured for royalties; and salaries and wages of such employees as must be retained in order to properly resume operations.

For most cases this affords a full cover.

BONDED INDEBTEDNESS.

In addition to the foregoing, some forms cover interest on bonded indebtedness, which is entirely proper when the insured has such indebtedness, while others cover interest on the cash value of the plant. The latter should not be covered unless it is known that the insured's books carry a charge for such interest. We need not go more minutely into details as to what fixed charges should be named in the policy if we bear in mind that all items of overhead expenses which would need to be continued during an idle period should be definitely included, and provided for in the amount insured. Sometimes valued policies go very much into detail in describing the cover. This

however, is only a form of window dressing indulged in usually, I believe, without intent to deceive, and does not relieve the company from the necessity of paying the exact amount named in the policy in the event of a total shutdown, regardless of the actual loss sustained.

Some underwriters omit entirely any definition of use and occupancy, perhaps preferring to allow the adjuster and insured to come to an understanding on that point after the loss. To my mind, that is not a safe method, for as I have already explained, the words "Use and Occupancy" have no legal status, so without a clear definition in the contract, both insured and adjuster would have a perfect right to hold to their own views, and those views might be—and usually are—widely divergent. Every use and occupancy contract should be clear and unmistakable in its terms. Nothing should be left to the imagination; no word that would serve to clarify should be omitted; no superfluous words should be added.

The rules permit the writing of use and occupancy policies of three kinds, i.e., those under which the same per diem amount would be collectable for each working day in the year; those under which the same per diem amount would be collectable for each working day of a period less than one year, but with the saving clause that the companies shall have no liability except between certain named dates; and those under which the per diem amount varies. Another form which, in the past, has been written to a limited extent, but which, happily, now is seldom encountered, is that which named a per diem amount that would exhaust the policy in a short time, say, 90 to 120 days, and undertook to pay for loss occurring at any time during the term of the policy. Under that form most losses would be total to the company, and the insured, more often than not, would be left dissatisfied because of the inadequacy of the cover. The revival of this pernicious cover, or one similar to it, is being urged in some quarters, and I cannot but feel that any effort toward that end is extremely injudicious at this time. When business conditions become normal it may be practicable to select certain types of risks which we could safely predict might be rebuilt and equipped in less than twelve months; now it is not possible to do so. Building difficulties are increasing, and the replacement of machinery alone is a problem which is causing some companies to accept use and occupancy offerings with great conservation. Right now many insured would be wise to have their policies written in amounts that it would require eighteen months to exhaust instead of twelve. Such contracts are written on the other side, and I see no underwriting reason why the insured's necessities could not safely be met in that way here.

With very few exceptions all kinds of business can be insured under one or the other of the permitted covers. The basic con-

ditions of liability underlying all approved forms are identical, with the result that forms necessary to afford proper protection to all classes of business differ only in relatively minor particulars. All policies are written on a per diem basis, and each if properly drawn must contain a partial payment clause, which would make it necessary for the insured to carry insurance equal to his full yearly net profits, plus fixed charges, in order to avoid becoming a coinsurer in the event of a partial interruption of his business.

While much the larger number of cases are cared for by a form naming a level per diem amount for each working day of the year, varying per diem amounts may be used for any business in which profits fluctuate widely in different seasons. For season risks, such as canneries, cotton oil mills, etc., a level per diem is named, payable only for loss occurring during a specified operating period.

As I have already explained, a properly worded form intended to afford full cover should include not only net profits, but also all fixed charges that could not be avoided during an idle period. An insured's wishes may, however, with entire propriety, be met by issuing a policy covering fixed charges only, or by one covering net profits only.. Neither, however, would give full protection to a profitable business, and, in my personal experience, I have met with but little demand for either. Nevertheless, I believe that a market for the fixed charges contract could be worked up, and I shall discuss that point further a little later on.

We may well spend a few minutes here in considering that exceedingly important condition, the partial payment clause; not only because it is of first importance, but because no other item of the use and occupancy contract apparently is so little understood. In the first place, the fact that every properly drawn partial payment clause is substantially a coinsurance condition should be clearly realized—which fact, by the way, should be explained to the insured with the same care as would be observed in making him acquainted with the conditions of a coinsurance clause. Perhaps I should explain that the term "partial payment," as applied to use and occupancy transactions, through usage has become understood to mean the payment for each day of a loss period, of something less than the per diem sum that would be paid for a total interruption of business. A wording commonly used for a partial payment clause, and one which meets all necessities, reads about as follows:

"and if by fire occurring during the period of time named herein the ability to produce the full daily average of goods be impaired but not destroyed, then shall this company be liable per day for said actual loss sustained in such proportion of a sum not exceeding $...... as the net profits so prevented from

being made bear to the full daily average net profits, it being understood and agreed that for the purpose of this insurance the average daily net profits for the ......days of full operation next preceding the date of fire shall be considered the full daily average net profits."

Many other clauses have been devised to cover this feature, and practically all of them are in effect coinsurance conditions. They differ from the one quoted principally in two ways. Either they contain in place of the words "net profits," "gross profits," "sales," "production" or some other term which the compiler fancied, or else they make no reference whatever to the period before the loss.

The following is an example of the clause which does not require that the experience prior to the loss shall be used:

"During the time of a partial suspension of business the per diem liability under this policy shall not exceed the same proportion of the per diem liability which would have been incurred by a total suspension of business, as the proportion by which the daily business at the time of fire is decreased."

Probably the mistake most often made in analyzing the partial payment clause which requires that the experience prior to the loss shall be used in measuring partial losses, is in construing it to mean that the limit of any loss occasioning either a partial or total interruption of business shall not exceed such past experience. In fact, the clause means no such thing. Its function is to measure partial losses only, and it has no other purpose in the form. The insuring clause in the contract obligates the company in the following words: "for actual loss sustained, not exceeding $...... per day." The partial payment clause we are considering simply provides, subject to the foregoing condition, a mathematical means of determining what proportion of an amount representing the actual loss that would have been sustained for a total interruption of operations shall be paid for a partial interruption of operations, and it neither qualifies nor amplifies the insuring clause in so doing.

Let us take, for example, a hypothetical case in which the policy reads: "for actual loss sustained, not exceeding $300 per day," and obligated the company, in the event of a partial suspension of operations, to pay such proportion of a sum not exceeding $300 per day as the product so prevented from being made bore to the full daily average product for the 300 days of full operation next preceding the date of fire.

In adjusting a claim under this form the procedure would be first to determine what actual loss the insured would have sustained had his operations been totally suspended. It is true that *in* determining this point the past experience would be used, but *only in conjunction* with a full consideration of what would have

been the result of full operations over the estimated period of business interruption.

Let us assume that the adjuster decided that $300 per day would be an equitable sum to pay the insured in the event of a total interruption of operations, and that the average production of the plant (an automobile factory) for the 300 days prior to the fire was ascertained to be six cars per day. Having established these facts, it would then be necessary to estimate how many cars could be turned out during the time the plant continued to be crippled. We will assume that the adjuster and the insured agreed that three cars per day could be produced. With these facts determined the contract would require the company to pay such proportion of $300 per day "as the product so prevented from being made bore to the full daily average product," which, applied to our problem, unmistakably would mean the same proportion of $300 per day as the proportion which three cars bear to six cars, which is 3/6 or ½; in dollars, $150 per day.

I read an article the other day in which a "prominent underwriter" was quoted as having given the opinion that such a partial payment clause as we are discussing would make the contract a valued one. If correctly quoted, that gentleman was laboring under the general misapprehension to which I have referred. In reality, the clause affords a perfectly clear method of arriving at an equitable adjustment. In my opinion, a crystal clear mathematical partial payment clause will be extremely necessary, at least until such time as our adjusters (speaking generally, for, of course, there are exceptions) have a better conception of the scope and purpose of use and occupancy contracts. Even under carefully drawn forms, both companies and the insured still suffer too frequently through loss transactions which evidence a lack of understanding on the part of the adjusters.

The limits of this paper will not admit of my taking up in detail the many variations of the partial payment clause which are in use. My very decided preference, as I have stated, is for the clause which uses past experience as a measuring stick. It supplies a more rigid guide for the adjuster, and operates fairly for both company and the insured. I wish, however, to speak briefly of one question in connection with this clause which during the past few months has become almost controversial—that is, whether it is better to measure the partial loss by the past net profits, past gross profits, past production or past sales. In practical operation, and with a competent adjuster having power under the contract to use his discretion, either could be used without detriment to company or insured. I am not inclined to lay nearly as much stress on this point as I am on the necessity for using some past experience as a guide in adjusting

partial losses. However, as I view the point, net profits would seem to be the better term.

Net profits are what we insure, and the term "net profits" can be used in forms for both mercantile and manufacturing risks. So can the terms "sales" or "gross profits," for that matter, but using sales might work out to the distinct disadvantage of either party to the contract. It is conceivable, for example, that an insured might have sales during a period of partial interruption that amounted to 50 per cent. of the full average sales before the loss, but upon which he earned less than 50 per cent. of the average profit on sales before the loss, so that the actual loss to the insured would be in excess of 50 per cent. Or the condition might be reversed, in which event the company would suffer.

I am opposed, on principle, so to speak, to the use of the term "gross profits" in any part of a use and occupancy policy. In my opinion, it is little short of criminal to insure the gross profits of any concern, although occasionally it is done, and even though the wording used is "gross profits less expenses and cost of material," I still prefer that no mention of gross profits be made because of the suggestion of impropriety which that term conveys to the mind. As to "production," while I used that term in illustrating the operation of a partial payment clause, it cannot always be used without reducing the production to dollars and cents and making it necessary to go somewhat outside the wording of the contract to effect an adjustment, which in itself is sufficient reason for using another term.

It would be impossible, for example, to take the varied product of an agricultural implement factory as a basis for measurement. To attempt to do so would result in a problem something like this. If the average production of a factory for the 300 days preceding the loss was ten harrows, twenty-five cultivators, five drills, and one threshing machine, and after the loss it was determined that the production would be reduced thereby to five harrows, ten cultivators, two drills and no threshing machines, to what proportion of the per diem sum named in the policy would the insured be entitled? It is obvious that the answer could not be arrived at without reducing the product to dollars and cents.

All of you are more or less familiar with the new rules which will regulate the writing of use and occupancy insurance. To those, however, who have not as yet been able to go thoroughly into the subject, I should like to make as brief an explanation as possible of the reasons which underly the rules—that is, of such of them as are not self-explanatory.

One rule which perhaps is not wholly clear as to its purpose *requires that policies* shall contain a clause limiting the liability *to such time (not* limited by the expiration of the policy) as

would, with the exercise of due diligence and dispatch, be necessary to replace the property named in the policy to the same condition as existed at the time of loss. The reference to property in the rule is there to prevent a claim being made that payment should cover such time after the restoration of the building and equipment (and stock if covered) as the insured might deem necessary to restore his working organization to the same condition of efficiency as existed before the loss. The contingency involved in the foregoing is too intangible to rate, hence the rule. I may say that this rule, like most others, was not enacted until experience had made the need for it apparent.

The rule requiring that policies shall contain the following clause:

"It is understood and agreed that as soon as practicable after any loss the insured shall resume complete or partial operation of the property herein named, or shall make use of other property, if obtainable, if by so doing the amount of loss hereunder shall be reduced; and in the event of the insured continuing business (in whole or in part) at some other location, or using other property during the time required in requiring or reconstructing the building named herein, the net profits earned at the new location shall be deducted from the amount that under the terms of this policy would otherwise be recoverable by the insured."

was deemed necessary to prevent an insured from being content to draw income from the insurance companies rather than to continue his business at some other available location. Also to require the insured to use other property, if same can be had, as, for example, would be quite possible if the insured operated one or more additional plants in the same or a similar industry. The condition of the rule which reduces the loss by the amount of the net earnings at another location is obviously equitable, since the company only undertakes to pay for actual loss sustained.

The rules in the West require that a coinsurance clause shall be attached to each use and occupancy policy. This is not a condition of the rules in force in the East and South. There the rules only require that coinsurance clause, or an average clause, must be attached to any policy which covers more than one plant. I can see no sufficient reason for requiring that a coinsurance clause shall be used on policies covering a single risk if the form is otherwise properly drawn, and I hope that the Eastern and Southern rule will shortly prevail in this field. As we know, the partial payment clause is the substantial equivalent of the coinsurance clause in so far as the interests of the individual company are concerned, so it would appear to be unnecessary to require that both shall be included in the form. It is impera-

tive, however, that an average clause shall invariably be used when more than one plant is covered under the same policy.

Another rule reads as follows:

"Policy forms shall include a clause reading: 'It is a condition of this insurance that the insured shall not be entitled to compensation on account of delay which may be occasioned by any ordinance or law regulating construction or repair of buildings, or by the suspension, cancellation or lapse of any license or by any other consequential damage.'"

No doubt you are familiar with building laws in force in some cities, under which in the event of a fire causing damage to a building exceeding a certain percentage of its value, the owner would not be permitted to restore the building to its original condition if damaged, or to erect another building of identical construction in the event of its being destroyed, but would have to construct a better building, one conforming with the ordinances for new buildings. This involves another contingency so indefinite as to be hardly subject to rate.

The reference to cancellation, suspension or lapse of a license had its origin, I think, in the adjustment of a claim on a certain hotel property. In the course of the adjustment it developed that the insured had been operating the hotel in contravention of the building laws, whereupon the authorities cancelled his liquor license. Inasmuch as the insured's principal income came from the hotel bar, he succeeded, under a loosely drawn policy form, in compelling the companies to pay for partial interruption far beyond the time that would have been required to repair the physical damage to the building and equipment.

The rule which requires that policies shall contain the following clause:

"It is a condition of this insurance that no liability is assumed on account of damage to the finished product, or for the time required to reproduce any finished product which may be damaged."

is very frequently misunderstood because it is a common practice to cover stock under use and occupancy forms. By the word "stock" in the insuring clause, however, it is intended to cover raw stock only. To include finished stock might extend the payment period by such time as would be required to manufacture new stock to replace that damaged or destroyed and, conceivably, by such further time as might be required to age the stock, as, for example, in the case of varnish factories, breweries, distilleries, etc.

The rule which requires that the word "day" or "working day," as used in the contract, shall be held to cover a period of twenty-four hours is necessary to prevent a claim being made for two or three days' indemnity in a single twenty-four hour

period, which in the absence of such definition might be done in the event of a plant operating two or three eight-hour shifts.

I have risked tiring you out by going into rather rudimentary details with respect to the contract because I had the feeling that there might be some among you to whom such minutiæ would be valuable, and also, to make a confession, because it has given me an opportunity to brush up my own knowledge.

Now just a word in summary before we pass on to the subject of rating. The more general writing of this class has produced a large crop of critics from whom we have received some help, but it must be confessed that many of the so-called new ideas thus far put forward belong in the class of things "tried and found wanting."

It is a pretty safe practice to stick to policy conditions that have been "time-tried" and "court-tested." Use and occupancy insurance, we know, is not a new business and we have some valuable court decisions which form at least a slender basis for our underwriting.

If some of you have not sufficient time to work up your own use and occupancy forms, or sufficient knowledge of the class to enable you to draw up a contract that will properly cover your clients and at the same time do justice to your companies, you need not consider yourselves out of the race, for the advisory forms published by the uniform forms committee are carefully devised and comprehensive instruments which may be had for the asking.

These forms have been drawn with scrupulous regard not only for the rules, but also for the interests of both company and insured. While there is much that could be said, and to which I could give hearty assent, in favor of allowing opportunity for the exercise of personal ability among agents and companies in devising forms bearing the stamp of their individuality, much also could be said in favor of uniformity.

Perhaps this is not the time for extended remarks on either side of the question, so I will only say, when in doubt use a ready to wear form rather than run the risk of committing your companies under an agreement that is lacking in one or more fundamental safeguards. To repeat, however, if you are to succeed to any extent in writing this class of business you must eventually understand the contract, and learn how to apply it to all conditions surrounding your customers' business.

RATING.

That the subject of use and occupancy for years has been one of minor importance to the large majority of companies is perhaps best evidenced by the fact that up to three years ago there had been no real demand for a modern method of making rates. There can be no question as to the necessity for at least unifying

rating rules, for such regulations as existed were at wide variance and none of them were wholly defensible.

Each rating jurisdiction in the East, West and South, with the exception of New England, where rates were open, had its own method of making use and occupancy rates. The fire rates were used as a basis. In one city or State the full building fire rate would be required for all classes of businses; in another, 75 per cent. of the fire rate; in another, 80 per cent.; in another, 90 per cent., and so on. Some rules used the stock rate, when stock was included in form, others did not. Average rates were worked out on a basis of property values in one locality, and in another perhaps directly adjoining the rule would require the use of the highest rate in a plant for a blanket cover. An assured owning property in two adjoining States would be obliged to familiarize himself with two different sets of rules for his use and occupancy insurance, and no one could tell him why.

When the necessity for a uniform rating system was generally realized, which, as I have said, was about three years ago, the work of devising a system was referred to a committee of rating experts drawn from the East, West and South and the schedule which was promulgated in 1917 is the result of their work. It was good work, for the task of fitting a schedule to use and occupancy conditions was a difficult one, and while no doubt experience will from time to time result in changes being made in the present schedule, it is, I believe, fundamentally sound in principle and as a whole will stand.

That the fire rate alone is no proper measure for use and occupancy liability must be obvious to all of you. In use and occupancy we must deal with two principal things, i.e., probability of loss and duration of business interruption. The fire rate takes care of the first, and therefore has its proper place in the rate schedule. To cover the feature of duration of business interruption required the chief thought of the framers of the schedule. This was comprehensively covered by a series of charges and credits in the schedule. There are charges for foreign made machinery, machinery made on special order, and machinery especially subject to damage; charges for process conditions out of the ordinary, and charges covering carrying conditions of time necessary for replacement of stock.

Recognition was given in the basis rates to differences in the length of time required for replacement in different types of construction.

Average rates are worked out by a method which properly ignores the property value, but instead considers the effect that the burning of each section of a plant would have on the interruption of business of the plant as a whole.

While I have said that the fire rate alone is not a proper measure for use and occupancy liability, that statement is more

particularly true of manufacturing business. In mercantile business, with no machinery or process features to consider, and with structural conditions more uniform, the use of a percentage of the fire rates as a use and occupancy rate would probably operate without injustice to company or insured. The new rating system provides for such flat rates on mercantile risks, and we can well afford to try out that method until experience covering a period of years has either confirmed or disproved its equity. In this connection it is well for us to remember that no statistics of any value are now available, as most companies have not segregated their use and occupancy business.

I wish that time would permit us to discuss the schedule more at length, but it will not require much study on your part to make yourselves thoroughly conversant with it, if you have not already had opportunity to become so. You should come to know it by heart just as, I presume, you do the fire rating system form, for I predict it is here to stay. Surely it has the same reasons for existence as any other schedule system, and we long ago determined that schedule rating provides the only practical method of fixing equitable prices in our business, and therefore the only defensible one.

UNDERWRITING.

Underwriting methods in this branch of our business are less uniform than in any other. This is quite understandable since to most companies use and occupancy is a new business. What I say to you on this head must therefore be largely an expression of personal views.

It is clear to me that unless practices become more conservative, particularly in the standard of risks acceptable for full coverage, the result will be to bring the writing of use and occupancy into such disfavor as to "kill the goose that laid the golden egg."

To insure under a valued policy a concern that is not conducting a profitable business is to invite a loss, and hence is contrary to public policy. To insure the same concern under a non-valued policy is to at least run the risk of being obliged to combat a fraudulent claim, which in the last analysis is no better.

Unless a business is well established, of good credit standing, and with demonstrated ability to earn a profit, it may not properly be insured under a full use and occupancy policy. In my judgment it is not alone sufficient for a concern to have what appears to be bright prospects. Companies have been formed during the past few years for the purpose of working under war contracts which promised enormous profits, only to wind up in the hands of receivers. To me it appears manifestly unsound to insure the prospective profits of such concerns, yet I regret to say that

it is being done. The only safe rule is to deny profit insurance to any concern that has not proven ability to earn a profit.

Speaking now more particularly on the physical side, theoretically one risk is as good as another under a proper rating system. It is a little early, however, to accept that thought literally. For some time at least there will be good use and occupancy risks and those not so good.

Every good fire risk is not a good use and occupancy risk. Very often of two risks, one fireproof and the other frame, the frame one is the better because it can more readily be replaced. Risks having specially made or foreign machinery are not as good as those using machines which can be bought in the open American market. The same is true as to stock when stock is involved. However, almost any risk is writable under a full use and occupancy policy provided it has the fundamental requisites I have mentioned with respect to business age and profit earning record, and for others there is the fixed charges policy. As I view it, there is nothing subversive of public policy or sound underwriting in protecting almost any concern by a policy under which the company undertakes only to pay for the loss of fixed charges during a period of business interruption, and I believe there are possibilities for working up considerable income through intelligent exploitation of that form of cover. There is a large field to work in, for the majority of risks are not proper subjects for the full cover, and the fixed charges policy has the advantage to the insured of not requiring a large outlay, for such policies naturally are written in comparatively small amounts.

In writing all forms of use and occupancy policies extreme care should be taken in describing property, the destruction of which would cause loss under the policy, and in clearly connecting the liability with such property. For example, it is not sufficient to say that the company shall be liable in the event that property "located in the town of........shall be destroyed." The exact location of such property by street or block numbers should be given, otherwise the company might be held liable for loss to other property of the insured in the same town, even in the event of such property having been built since the policy was issued. Neither is such a clause as the following proper: "If by fire occurring during the period of time named herein the insured is prevented from carrying on his business." Under such a form the company might be liable for fire occurring in South Africa, for example, if the assured was dependent upon the product of the risk destroyed or damaged in South Africa for the continuation of his business. A clause reading: "If by fire occurring during the period of time named herein the property described *in this policy* is destroyed or so damaged as to prevent the insured *from carrying* on his business" clearly limits the liability

to loss resulting from damage to the property named in the policy, as it properly should.

I speak of these things here because they are not clearly covered in the rules and therefore in a sense are matters for underwriting judgment.

Now just a word on the question of whether use and occupancy is consequential insurance in the sense that the liability is so separate from direct fire liability that companies may safely accept use and occupancy lines in addition to full fire lines on the same risk. Up to a short time ago I should not have considered the question open to debate, but quite recently a well informed man was quoted as having said in an address on use and occupancy that some companies did not consider use and occupancy liability as additional to liability under direct policies on the same risk. Can you conceive of a fire of any magnitude not causing a use and occupancy loss to a profitable business? I cannot, and I feel perfectly safe in saying that when you have given your companies their full lines under direct policies, they will not also be open for use and occupancy insurance on the same risk. If, however, any companies are really ignoring the cumulative liability they assume under use and occupancy policies, I predict they will do so only until a loss adjustment makes the mistake apparent.

In conclusion I feel obliged to express my firm conviction that the future of the use and occupancy insurance is very largely in your hands. You can make it increasingly important, or you can bring it into such disfavor as to limit the income to a negligible sum. Most certainly the indiscriminate and unintelligent writing of this business will tend to increase the fire waste—the very thing all of us in other ways are combatting. I think that a large share of the responsibility should be placed on your shoulders because you are the ones who develop the business, and it is upon you that we in the company offices place our dependence for the fundamental facts upon which we must base our underwriting. If you will make it a rule never to introduce the subject of full use and occupancy insurance to any prospect until you know he will make an acceptable risk, you will be building a permanent foundation for this branch of our business to the ultimate benefit of your companies and yourselves, for your interests and theirs are inseparable.

SCHEDULE RATING.

Science Superseding Snap Judgment—Moral Hazard a Matter of Underwriting Judgment.

Written for THE WEEKLY UNDERWRITER *by an Expert on Schedule Rating.*

Prior to the advent of most of our modern methods of determining rates by schedules, the snap judgment of an individual was adopted as the basis of computing a premium. Naturally this individual, to whom was intrusted the prime importance of naming the rate, was supposed to be imbued with a considerable amount of experience and a certain amount of horse sense. It is related that in a small Southern town boasting of four local agents and a hose wagon, schedule rating crept in to remove the suspicion of unbalanced premiums. In those days, so the story goes, a rather crude schedule produced rather weird results, so that in the case of the furniture factory which was the pride of the community and the means of sustenance of three of the four locals, a rate of $6.60 was produced as against the snap judgment of $4.75.

The indignant proprietor demanded a meeting of the local board (three constituting a quorum) for the purpose of review. The quorum, who controlled the business, seemed at a loss as to how to appease (1) their joint client, the proprietor of the factory and (2) their respective clients, the companies on the line. The schedule was none of their making so they addressed an appeal to headquarters for assistance. Came then in due time, the rating-inspector who enlightened them as to the rate, its makeup, its penalties and its possibilities. When he had gone, the quorum called on their customer and began explanations. The spokesman had proceeded brilliantly and the owner was listening to all his oratory without a word of protest or commendation, until the interpreter of the schedule came to item 16, pails. "What for," he said. "To put out the fire," was the answer. "What do I save?" came next, "and how many do I have to have?" The quorum went into executive session over this, the first cross examination of the interview. "It says here," stammered the spokesman, referring to the many pages of criticism and suggestions left by the departed rating-inspector, "that you need twenty pails on each *floor,* and the rate allowance is ten cents." A profound look *of gratitude* came over the insured's face; he saw at once the

advantages of schedule rating and he told his quorum he was perfectly satisfied. He would order at once enough pails, at ten cents each, to reduce his insurance cost to nil; and, if need be, enough more to enable the companies to pay him for the privilege of insuring the property.

SCHEDULE FUNDAMENTALS.

Crude, in comparison to present day schedules, as the earliest efforts were, it nevertheless remains a truism that our present day schedules, or most of them, bear close resemblance to their forebears. The Underwriters' Association of New York State published a manual for special agents' use, and as far back as 1892 their schedule for rating shoe factories was not so vastly different from the present day schedules used for rating manufacturing risks in buildings of non-fireproof construction in New York city. Of the schedules used by the New York Fire Insurance Exchange, possibly the one more closely analyzing hazards is the Mercantile. Take any one of the twenty schedules used in New York city, and three fundamentals stand forth prominently: hazards of construction, occupancy and exposure. Unless you expect the sprinkler schedule, which in itself is based solely on "protection," the interior protection afforded any risk is considered as a secondary item. From this statement the deduction should not be drawn that any of the schedules disregard protection features. Quite the contrary. Merely emphasize in your own mind the fact that in rating a non-sprinklered risk the questions uppermost are: construction, occupancy and exposure. In a sprinklered risk the dominant factor is "What degree of protection will the risk have?" Having determined on this, the application of the schedule itself is decided. The line is drawn, as to the application of the schedule to a risk equipped with sprinklers, to the degree of protection afforded. Under a supplementary schedule used to grade the sprinkler equipment itself, penalties, if any, are imposed for sub-standard conditions and if these total in excess of sixty points the risk is deemed to have insufficient protection to warrant the application of the sprinkler schedule. If the reverse is the case, the schedule is applied as in other risks and with the same considerations, namely: construction, occupancy and exposure.

MERCANTILE SCHEDULE.

Much has been written and spoken about the Mercantile schedule now used by the New York Fire Insurance Exchange. While it is applied to a great number of risks in New York, it does not rate a very large number of classes, a possible five, for example, as compared to a possible thirty-four for what is known as the General Schedule. The framers of the Mer-

cantile gave it the name of "universal," setting forth as one of its merits that it could be applied in any locality from Portland, Me., to Portland, Ore. As used in New York it has lost some of its birthday attire and possibly its framers would declare that their statements were borne out by its very adaptability to classes in New York under varying degrees of stress. First of all, its key rate, originally determined at 20c for the Borough of Brooklyn, has been reduced to 10c. Quite a number of modifications were found necessary to rate buildings of strictly or partial office occupancy. Likewise the advent of light manufacturing into risks of mainly mercantile occupancy brought about the introduction of additional items not contemplated in the original draft. The *form,* however, has undergone no change. The construction features are first treated, next the occupancy, then exposure. As certain as death and taxes these three constitute the main items. It is left to the whims of the assured to provide protection or remedy housekeeping defects. Under the New Jersey ratings, their "general" schedule as filed in Trenton might be considered as a close relative, or at least in "in-law" to the Universal Mercantile. In fact, most of the New Jersey schedules operate under the same order. The so-called "manufacturing" schedule in use locally while recognizing, as all schedules must recognize in one way or another, the fundamentals of the Mercantile, is somewhat simpler in application, and being less prone to split hairs, its rates average higher than the Mercantile would produce under the same conditions. While the Mercantile uses a system of classifications for occupancy hazards, based on the combustibility and susceptibility of the contents, the manufacturing schedule, with a few exceptions confined to the clothing and allied industries, use base rates which are primarily determined on the combustibility hazards.

DEAN SYSTEM.

No one of the schedules in use in metropolitan areas, New York Exchange, Suburban Exchange, or New Jersey, attempt to differentiate between the hazards of a coal stove in an office and one in a woodworking establishment, whether safe or unsafe. The Dean Analytic System, used generally in the West, treats this angle of the measurement of the fire hazard in a much more comprehensive form. It is claimed for the Dean system that more science enters into its application than in any other system, that it is a building code and a set of police regulations all in one.

Probably no schedule yet devised makes any provision for the moral hazards which may be present in a risk. That is one consideration left to the individual judgment of the underwriter accepting the line. Moral hazard and its measurement present

rather serious difficulties. Misjudgment may entail a lawsuit and if a penalty charge were to be added in a rate for a given building containing a suspect, it might prove a rather difficult matter to make out a case. Lack of fire extinguishing equipment, or the presence of a concrete hazard is quite another thing, however, and the imposition of penalties is productive of two things.

As has been said, the improvement of property from the fire standpoint is largely a matter of business. If it pays to have a well equipped manufacturing or mercantile plant, the owner will install it; if it does not pay he would nearly as willingly continue to do business in a fire trap, and the difference between the cost of a fire trap and an improved risk is in the insurance rate. Thus, if an insurance rate appears to be abnormally high, it is most certain he who pays will question why. The questioning should be directed to one who understands the ramifications of the science which produced the rate.

Were the suggestion to be made that two communicating frame buildings could be rated separately by the installation of fire doors at the opening, some one would be treated to the surprise of his life if he tried to get away with it under the existing local rules. And our spokesman for the quorum would have difficulty in securing a reduction of ten cents for each pail installed in a building, on Manhattan Island. "Cost plus" governed many of the war time contracts. The correction of defects, structural or occupational presents but one view to most insureds. "How much will it cost and what will I save?" Too often is the fact overlooked that a condition corrected may not only save the building from fire but the business from destruction. To what extent owners of insurable property will go in order to obtain the minimum cost of insurance at the minimum outlay of expense may be illustrated by a case where allowance was withheld for lack of a standpipe equipment. Influenced by a misguided adviser, the owners purchased a quantity of fire hose and had it neatly folded on racks attached to a steam pipe riser. All credit to the man who will expend $100 in a lump sum and be content to secure its return within four, or five, or even six years. Many such there are, who feel the investment well worth while through safety of risk even though the monetary return is somewhat delayed.

THE PERSONAL TOUCH.

While the insurance companies through their rating organizations are preaching and teaching the owners of insurable property the doctrine of fire prevention, credit should not be withheld from the man who comes in direct personal touch with the man who pays the premiums. It is his business to know and to explain clearly the reasons for penalty charges in rates.

It is rather difficult, at times, to explain to an insured that by reason of the application of a certain schedule the rate is so low that no further reduction can be secured even though in the present rate no credit is given for fire extinguishment equipment. On the other hand, it is likewise difficult, sometimes, to explain to the underwriter how it is that a risk can rate so very low when subject to such a severe external hazard. Like some human beings, schedule rating is sometime consistent in its inconsistencies and no amount of science is going to overcome the difficulty. General average would seem to be the only solution.

When one considers the vast amount of insurable property in and around New York, and the thousands of schedule rates which are applied, the inconsistencies simmer down to a negligible quantity. Furthermore, as each inconsistency is discovered, an effort is made if it be a serious one, to dress down the schedule and provide against the reoccurrence. If this handling of the situation harks back to the "rule-of-thumb-snap-judgment" days, just consider that every schedule to-day in use, be it in New Jersey or Ohio, is the outgrowth of experience applied, revised, reapplied and dressed down.

NEW YORK SCHEDULES.

This article has been merely a skimming of the surface, if an exposition of any one schedule was anticipated. With over twenty-five schedules in use in New York Suburban and New Jersey territory alone and twenty in New York, a total of over seventy in all, several volumes might be devoted to their explanation and application. Brief mention might be made, however, of the seven most important, in point of number of actual risks applied to, under the capable handling of the New York Fire Insurance Exchange. In their alphabetical order they are:

The Comprehensive for rating buildings of fireproof and non-fireproof construction occupied mainly for dwelling or living occupancy, with or without ordinary stores; hospitals, homes, Y. M. C. A. buildings, clubs, etc.

The Exposure table (or schedule) for the measurement of the exposure hazard from adjoining or adjacent buildings. Now used to determine the exposure charge for application in any schedule in use locally.

The General for rating certain classes of dwellings, with or without stores; business buildings of light occupancy and complying with certain conditions as to occupancy above the grade floor; stables and garages under certain limited conditions; theatres and motion picture houses of limited capacity; and certain other classes of risks which may be entitled to special treatment.

The Manufacturing for rating hazardous occupancies; manufacturing risks; repair shops and, if building of fire-proof construction, cold storage warehouses and meat product manufacturing risks.

The Mercantile for rating offices, mercantile establishments; certain storage stores and warehouses.

The Sprinkler Rating schedule for any risk, regardless of occupancy or construction whose sprinkler protection is of a standard as developed by

The Sprinkler Grading schedule, used to grade the sprinkler equipment itself.

These last two are properly one, as each is dependent on the other for its own usefulness.

LINCRUSTA WALTON WALL PAPER.

A Brief Description of the Process of Its Manufacture.

By Charles C. Dominge, Insurance Engineer, New York City.

"Lincrusta Walton" wall paper is composed of the following ingredients: chalk, dry colors, oxidized linseed oil and wood flour. These are placed in a large mixing machine (similar to a meat chopping machine); a roll of manila paper (sometimes slightly oiled) is then placed in front of a large steam rollered colander. Before the paper starts to pass through the rollers the above composition is shoveled on the paper. The paper and composition passes under the rollers of colander, and then under another set of rollers containing a brass design. The paper then passes to a transportator (which is a roller of wood, felt and steel blunt pins). The object of this transportator is merely to hold the paper taut, and from this last named machine it passes over to the finishing table. The hazard involved comes from the drying process; there is also danger from spontaneous combustion from the dust and linseed oil. Extreme care should be taken that there are no open lights, and the place should be well ventilated.

OBSERVATIONS BY A FIRE PREVENTIONIST.

Every-day Problems, Whence They Arise and How They May Be Solved.

By M. M. Hawxhurst, Michigan State Agent, Mutual Fire Insurance Company.

The secretary of a fire prevention association comes in touch with the public, the special agent, and the companies, in a little different relation than does any other insurance man. They, all of them, have idiosyncrasies. It is about these queer twists of character and their effects on our business that I am going to talk.

In Michigan we hold fire prevention meetings for inspection once a month excepting in July and August. Either one large town or several small ones are inspected at each inspection. The town or towns to be inspected are divided into districts so that each committee of two men may have as nearly the same amount of work as is possible. The attendance at these inspections give an interesting sidelight on the character of the field men. There are certain ones that are always there and do their part and do it well. You can be pretty sure that the work that they do for their companies is of the same character. There are others who come occasionally and do their work well when they do come. These men are the ones, in most cases, who feel that their work for their companies is so important that they must not attend a meeting if they have any company work that may seem pressing. They are overlooking the larger aspects of the case and do not see that the fire prevention work is of more lasting importance than any individual thing that they may accomplish. Then there is the occasional man who, although sometimes he represents a large company, is either too lazy or too indifferent to take his share of the burden. Lastly, there is the smart, tricky man who takes advantage of any meeting when the field men are busy to get in some good licks out in the field. Let us be thankful that men of this stripe are rare.

INSPECTION WORK.

The good all-around inspector is a rare animal. We, most of us, have our hobbies and look for certain things when we make an inspection. Each man usually finds the defects that he is looking for. In one case it may be defective heating apparatus. In another it may be rubbish, and the inspector searches every *closet and out* of the way corner. Another inspector may be

particularly interested in electrical equipment and reports every overloaded wire and defective switch much to the disgust of the "jack of all trades" electrician in some of our smaller towns. You can nearly guess how carefully a committee works when they inspect a district in a large town and find no defects to report but open sidewalk grating in front of the buildings. It sounds something like the Pullman inspections that some of the older field men tell about. Then there is the Dean schedule man. Here I must go lightly as a large number of our newer field men are of this class. Not long ago one of our eminent authorities was complaining that the inspection bureaus were robbed of men by the companies and that these men made but half-baked special agents. One wag in commenting on it remarked that if they were half-baked at least they had been well roasted. I am one of the class myself so could appreciate both sides of the case. The tendency of these men is to go into a risk with their eyes open, their mouths shut, and with a sharp pencil. They are apt to report small defects which could often be remedied at the time of the inspection if the case were taken up with the tenant of the building. In comparison there is the tolerant man who overlooks most defects as being of minor importance and is apt to spend more time talking to those he meets about politics, the war and the crops than he is to making inspections.

The slips, filled out by these inspectors giving the defects found, are taken by the secretary and notices sent to the property owners or tenants, in cases where the inspector is unable or fails to get the owner's name. If no answer is secured by this first notice, a second request is sent which is much more peremptory in tone than is the first one. The cases where corrections are not made and an answer sent to the secretary are turned over to the State fire marshal's office for attention by his deputies. It is the answers to these requests for corrections that bring the secretary in contact with the public.

ATTITUDE OF PUBLIC.

It is a surprising fact that a large percentage of the property owners are glad to receive suggestions for betterments and follow out the suggestions in good spirit and often thank us for our interest. This is noticeably so where the inspectors have talked with the owner or tenant and explained what we are trying to do when they were making the inspection. Then there is the grouch who never answers at all, or if he does, does it in such a way that you can read his mood in his answer. He resents any suggestions for betterments as unwarranted interference from outsiders and considers it none of our business how much rubbish he keeps in his cellar or how defective his electric wiring may be. The idea that he is harming the community never seems to enter his head, or if it does, he is too narrow or too selfish to

care. This sort of a man is generally a poor busines man. If we could have them marked "grouch" in Dunn and Bradstreets, we could certainly improve our loss record. In connection with the improvement of loss record, there is one class of business that seems, from our experience with it in the fire prevention work, to be generally poor. I am referring to the property of estates, particularly in the medium and small size towns. It seems to be the general rule to allow these properties to depreciate both as to repair and cleanliness. It may be that this is because they are often in the hands of attorneys who, if they do not make a better job of being trustees of estates than they do of being insurance agents, are poor business men.

We get a number of replies at each inspection that are evasive. The defects which are easily corrected are taken care of and nothing is said of the other requests. A number of times the company for which I work has had insurance for these men and an examination of the commercial reports generally reads about like this: "Slow in meeting his obligations, said to be doing a fair business only."

There is another fellow who comes nearly in the same class that we call the "promiser." He will promise to do anything without the slightest intention of doing it. These are the class of men that make reinspections necessary.

Not long ago one of the members reported that the Sanitary Lunch Room at 579 Main Street E. in one of our medium sized towns, belonging to a certain lady, had a tile flue in the rear room and asked to have a brick flue built in its place. The request was carefully sent by the association and the lady came back with the answer that there was no tile flue in the Sanitary Lunch Room and she could not see what one would want with a brick one, anyway she put in all new, modern plumbing last year. We were at fault in following the technical wording of the inspector's report too closely. We had to write her that we wanted a brick chimney built.

Another reply received, also from a lady, stated that she had had all the things done that we requested and had also had the faucets fixed on the second floor. This last evidently showing a guilty conscience. One man replied, when asked to install metal pipes for gas stove in place of rubber tube, as follows: "Your inspector don't know beans, we hain't used that gas stove for seven years." In this case the inspector was at fault for not talking with the man when he made the inspection. One lady in Saginaw worded her reply about like this: "I am not going to clean up any more rubbish until you make Mr. McCrumb next door clean up his; anyway, he is a mean old thing because he built a cement curb on the side of his lot next to mine and I cannot have a team drive in and get the rubbish but have to have it all carried out in baskets." The funny things

do not all come from the dear public. Sometimes one of the special agents makes a funny break. One man, now out of the field, reported at Petoskey, that a certain store was very dirty, and that the condition was particularly bad in the coal chute, spelling chute "shoot." Another special agent, I do not know who, reported at an inspection at Ypsilanti, Mich., that a chimney disappeared in a blind attic.

One defect that causes us as much worry as any that is reported, is the heating of banana ripening rooms in fruit houses. These are generally heated by open gas flame and with the hay used in packing bananas scattered around, it constitutes a serious hazard. Mr. Dean, in his schedule, says that there should be a charge of 20 per cent. of the basic rates unless heated by steam or hot water. This is rarely the case, and it certainly seems that some standard of gas heating should be devised that is reasonably safe.

RATING BUREAUS.

This brings me to the discussion of a topic that I approach with some hesitancy and that is, the relation of our rating bureau to the fire prevention work. I realize, as most of you do, that our rating and inspection bureaus have about as much work as they can reasonably be expected to do. Yet the companies are missing a very valuable service that the rating bureaus can render and can do better than can any other agency, and that is, a very efficient fire prevention inspection work. I do not mean that they should devote any time to this, solely, but merely in connection with their routine inspections. The raters are, every day, making inspections for rating purposes. Why should not the same inspection take into consideration the defects usually reported by the fire prevention inspectors and an effort be made either through the fire prevention associations or the fire marshals' departments to have these defects corrected? Would it not seem that the keeping of ashes in wooden baskets or boxes should merit as much attention as a parapet that is six inches short of being the proper height? This sort of work would broaden the outlook of the average rater, would lead him to include in the make-up of the rate, as after charges, many defects that we are trying to get eliminated but which the inspection bureau rater never sees. This would bring the companies, through this service, into closer and more sympathetic touch with the public. It seems utterly inconsistent that this work is not done by the rating bureaus while we are spending so much valuable time and effort in trying to accomplish the same result in a different way. Do not understand that I am favoring the elimination of the fire prevention associations; I am not, but merely feel that their work should be supplemented by the work of the rating bureaus along this line of endeavor.

We can cure many evils by making inspections and requesting improvements but the crime of arson cannot be cured in that way. It would be a great deal like a doctor of medicine trying to save souls by giving drugs. Arson calls for an entirely different treatment which can only be administered by the companies through the education of the public. There can be no question but that arson is rampant in our cities. It is encouraged by the loose way in which losses are adjusted and paid and is aided, if not abetted, by the adjusters for the assured who are feeding on the life blood of our business. It is to be regretted that the insurance commissioners of some of our States, at times, urge and even insist on the payment of claims that are being investigated by the companies before these investigations can be completed. At the present time there seems to be a tendency on the part of some of the commissioners to encourage the companies to a more careful investigation of losses. That this evil can be checked is evidenced by what one field man, in Michigan, Mr. Fred T. McOmber, State agent, of the Springfield Fire and Marine insurance company, has accomplished in the City of Detroit. Mr. McOmber started in to investigate two losses in Detroit which seemed to him to be crooked, little thinking what a nest of crime he was about to uncover. He took the cases up with the State fire marshal, Frank H. Ellsworth, the prosecuting attorney of Wayne county, the commissioner of police of the city of Detroit and the fire marshal of the city of Detroit. The State fire marshal assigned three men to these investigations and the commissioner of police assigned two of his best detectives. In the beginning, the most efficient service was rendered by Messrs. Schuyler and Weinfeld, attorneys with offices in Chicago, who were connected with the arson investigation in that city. It was an operative from their office that uncovered the first clue, through a woman that was closely connected with the "arson ring," which led to the confession of the "chief torch," Morris Coleman, who admitted setting about thirty fires. This confession implicated a number of individuals who had had fires in the last two or three years and brought into the case so many other companies that the investigation became a matter of general interest. There are claims against the companies, that would ordinarily have been paid, aggregating $250,000 that are being held up on account of this investigation. Most of this never will be paid. There have been twenty-nine arrests made and it is a significant fact that twenty-four were Russian Jews and five were Italians. Four of these men have confessed and are either sentenced or are awaiting sentence. The rest of them are awaiting trial. Two other cases came up at the same time but not through this particular investigation. In these cases two men

were convicted and one of them afterwards committed suicide. Another "torch" was implicated later in the investigation of a fire for one, Louis Moore, Coleman claimed that he did not set this fire but that he knew who did the job. When asked why he did not set this one, he replied: "I would not work for that fellow. He is a damned crook." The cure for arson lies more in educating the people as to the enormity of the crime than it does in any effort that can be put forth by the companies along other lines. The conviction secured at this time was the first conviction by jury for arson that had been secured in Michigan since 1872. In one of these cases, the store that was burned was on the ground floor of a building that was occupied on the upper floors for hotel rooms. There were seventy-eight persons in these rooms on the cold January night that it was touched off. All of these people escaped in their night clothes or in scanty attire. The price paid for the job was $700. This is less than $10 a head for potential murder. The murderer commits his crime in the heat of passion or when in a tight corner but the arsonist plans his crime in cold blood and takes no heed of the lives he endangers. If we could get the public generally to understand this fact we could be more assured of securing convictions in court when these cases come to trial.

RELATION OF THE COMPANIES.

We come finally to the fire prevention work. Some companies are enthusiastic in their support, others are lukewarm and some few are antagonistic and seem to feel that any time that their field men spend in this work is wasted. There is no inspector who is so good that he cannot learn from some other man. This fire prevention work is good training for any man and is particularly so for the young man, just entering the field. Some managers have said to me, "I cannot see that all the work you do has much effect on the loss ratio of your State." This is no doubt true, but all the risks that you cancel do not burn either. Unfortunately, it is hard to see any general results from this work at times. It is only by looking at particular cases that we get encouragement. For instance: Bay City, Michigan, was inspected by our association twice in three years. The chief of the fire department sent some of his men out with the inspectors at the last inspection. The inspection work was then carried on by the fire department with special attention paid to rubbish in the basements. The chief told me not long ago that they had not had a rubbish fire in a basement in Bay City for over two years. This may not have a very decided effect on the loss ratio of the State but certainly shows that the work is worth while. It has often been remarked by the field men of our State that the towns inspected by the association immediately stop having

small fires and seem to be immune for a year or so. This is certainly worth while.

There is another feature of our work that does not seem to have come to the attention of but a small number of the companies. That is the confidential bulletin issued by the association after each inspection. In this are listed the risks in which defects were found and a brief summary of the defects in each risk. Some risks are marked "inspection advised." This is because the conditions are so bad that no company should continue it without careful consideration or because the inspector saw something about the tenants which led him to be suspicious. This information is invaluable to the daily report examiner and should not be neglected by any company.

In conclusion let me say that the work of the fire prevention associations has been valuable to the companies and can be made much more so if it receives the full support of the companies and the field men. It is along the lines of conservation laid down by the President of the United States and may in the end prove the salvation of our business.

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